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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*, 42(4), July–August 2012: *Optimal Strategies in Sports Economics and Management*, Sergiy Butenko, Jaime Gil-Lafuente, and Panos M. Pardalos, eds.; *Foundations of Location Analysis*, H. A. Eiselt and Vladimir Marianov, eds; *Metaheuristics: From Design to Implementation*, El-Ghazali Talbi; *Data Mining: Concepts, Methods and Applications in Management and Engineering Design*, Yong Yin, Ikou Kaku, Jiafu Tang, and Jian-Ming Zhu.

BUTENKO, SERGIY, JAIME GIL-LAFUENTE, PANOS M. PARDALOS, EDS. 2010. *Optimal Strategies in Sports Economics and Management*. Springer-Verlag, Heidelberg, Germany. 231 pp. \$139.00.

Optimal Strategies in Sports Economics and Management draws mainly from presentations at a conference that took place in Barcelona in 2009. The conference title, *Economics, Management and Optimization in Sports After the Impact of the Financial Crisis*, would perhaps have represented the themes of this book's 11 papers better than the (rather clumsy) book title does. The papers include much analysis from the fields of economics and management of how the financial crisis affects sports; however, they include little on strategy. Potential readers should not be misled into thinking that they will read anything about sabermetrics. The book contains no direct coverage of on-field strategies; curiously, it does include an analysis of strategies for betting on jai alai.

The papers are contributed by researchers whose perspectives come from a variety of disciplines—management science, statistics, business studies, economics, and political science. Thus, the approaches are very disparate, as are the topics; for example, they range from the impact of the recession on American professional sports, through how to improve the image of three sports events in France and how news-

papers in Edmonton treated demands that the city fund a new ice hockey arena, to the technical issue of how golf handicapping rules could be modified to promote more even contests. Without the unity that could have been derived from either a single disciplinary perspective or from some commonality of topic, the book struggles to justify itself. Although most students of sport would doubtless find something of interest, few are likely to want to read more than one or two chapters. As a collection, this book is not likely to be selected for purchase for many private bookshelves.

The management science chapters are at the beginning. Jaime Gil-Aluja and Anna Gil-Lafuente draw on the concepts of similarity and affinity in considering how to formulate algorithms to help management choose groups of players, taking account of their qualities and recognizing that they will play as a unit rather than as individuals. This appears to be a relevant issue for sports clubs (e.g., soccer clubs that are deciding how to allocate funds in the transfer market). However, the treatment is somewhat austere: the chapter sets out theoretical principles but provides no examples to illustrate what, for example, aptitudes might mean in the context of sports, how to apply numerical values to them, or even whether they refer

to levels of ability or, alternatively, to skills in particular tasks. In the future, this chapter might usefully be developed into something more akin to a set of user instructions.

Economists write the most chapters. Brad Humphreys and Stefan Szymanski each consider how recession impacts professional sports, neither finding much effect to date in the North American and European contexts, respectively. Humphreys takes the broader and the more discursive approach, speculating about the several channels through which austerity might depress revenues, for example, through a reduced use of corporate hospitality; his chapter also includes a useful review for novices of how the organization and economy of professional sports differ between North America and Europe. Szymanski's chapter is on attendance in European football. He presents regression results for determinants of season-to-season changes in average attendance in each country's top-tier league. The pattern of season-to-season changes across countries appears unrelated to differences in severity of recession; however, a novel finding emerges—that attendance is lower in seasons following a football summer, when either the World Cup or the Euro Championship has taken place. Although the lack of a relationship with recession is interesting in itself, an unconsidered complication is that some leagues are very dependent on season ticket sales and these, which may substantially drive mean attendance during the following year, take place at a very specific time such that an annual growth rate in GDP may capture the relevant state of the economy somewhat inadequately. Ignoring the distinction between attendance by season ticket holders and those who are not season ticket holders is a problem throughout the attendance demand literature.

Sports economists often have their differences; however, they display remarkable unity in opposing demands from professional sports clubs for municipalities to build new stadia for them. Nevertheless, despite every academic study finding economic benefits to be too low to justify the investments, dozens of North American cities have decided to impose the burden of a new stadium on their taxpayers. As interesting as the proposition that a stadium gives very little boost to a local economy is, surely, the question of

why the economic advice is typically ignored is more so. This question is seldom asked in the literature. In this book, Daniel Mason presents relevant evidence in the form of a case study of Edmonton, Alberta. It is based on content analysis of local media output and how the terms of the debate on a new arena changed as the months passed. As such, it presents an interesting tale for those curious about the political economy of decision making.

Mason's contribution to the book is strong; however, his content is far removed from the quantitative analytical approach that might be expected based on the book's title. Indeed, several other chapters eschew quantitative analysis altogether. For example, Lionel Maltese and Lucien Veran present a case study of how organizers of three international sporting competitions held in France might more effectively exploit these competitions. Their argument is couched in the language of business studies and their research is only qualitative, based on interviews and press reports. This is not to denigrate their work; however, it sits uncomfortably in a volume that begins with two highly technical management science papers, illustrating further that the book is something of a hotchpotch and lacks a clear purpose.

Nevertheless, the reader who is looking for information on how good applied statistics might help sports will find some consolation in the study by Patrick Siegbahn and Donald Hearn, which analyzes the system of handicapping in golf, insofar as it relates to fourball competition. This chapter adds to the small but flourishing literature on this topic in journals. To my mind, authors of articles on handicapping have done a good job of finding ways to improve the system in different types of golf competition; however, they tend to neglect the question of what the goals of handicapping are or should be. Although Siegbahn and Hearn refer to their chapter as a study in fairness, they appear to assume that fairness simply means an equal chance of winning for each team. But, would an equal chance be fair? Should not the better team win more often than not? Is there not a trade-off between justice (the reward of higher ability) and the promotion of an exciting contest, and might the purpose of handicapping then be to just lessen the probability that the better team wins? Even good statistics

such as are found here might need some conceptual, theoretical, or even philosophical underpinning.

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EISELT, H. A., VLADIMIR MARIANOV, EDS. 2011.
Foundations of Location Analysis. Springer, New York.
522 pp. \$239.

Everybody in the field of location analysis knows the names of Hotelling, Voronoi, and Weber, but who has actually read their papers? Hence, a book that investigates and discusses the origins of location analysis and the papers that have shaped this field seems a laudable idea to me. The editors of *Foundations of Location Analysis* originally thought of republishing some of the most famous seminal articles that shaped location theory, but chose instead to discuss such papers and their influence on later research. Most of the seminal papers discussed were published in the 1960s and 1970s; the editors point to Hakimi's mid-1960s works as the beginning of modern location theory. However, the earliest location theory reference in this book is Fagnano (1775), supporting the claim that "facility location is the oldest topic of Operations Research" (p. 76)!

The chapters show two main lines of development. One arises from purely geometrical considerations. Problems that Fermat and Fagnano posed centuries ago for which they had no applications in mind, we think of today as mathematical puzzles. Only much later did geometrical problems find their application in facility location (e.g., Vázsonyi-Weiszfeld did not realize for decades that his algorithm had become a standard tool of location theory!). The second stems from considerations of spatial economics or human geography; the earliest applied works, starting from von Thünen (1826), were based on observation and production patterns and used little mathematics. (For brevity, I indicate if the models relate to economics or geography, but give no indication for the more common mathematical models.) Although the editors admit that achieving notation uniformity was impossible, this book has a remarkably homogeneous style. A central theme, the presentation of the original contributions followed by a survey of later developments, enables us to see how early works had substantial impact decades after their publication. One

author points to this as a criticism of "the validity of some current quality evaluation methods for scientific research, e.g., impact factors" (p. 386).

The first section of the book addresses the basic models of location theory, divided into three categories according to their objective functions: minisum, minimax, and covering. Minisum models minimize the sum of the facility-to-customer distances. Chapter 2 discusses the simple plant location problem, reviewing the contributions of Erlenkotter, Kuehn, and Hamburger. Chapter 3 investigates median problems in networks, where ReVelle, Swain, and Hakimi made their classic contributions. Minimax models try to achieve equity by minimizing the longest customer-to-facility journey. Chapter 4 reviews the continuous centre problem, presenting both Chrystal's early geometrical approach and Elzinga-Hearn's modern algorithm. Chapter 5 looks at the discrete centre problem, reviewing the papers of Hakimi, Goldman, and Minieka and their impact on subsequent research. Chapter 6 looks at two types of covering centre problems (covering means that a customer is within some specified distance from a facility). In the set covering location problem, which Hakimi introduced but Toregas, Swain, ReVelle, and Bergman solved more efficiently, one wishes to minimize the number of facilities opened to cover all demand; in the maximal covering location problem, which Church and ReVelle introduced, one wishes to maximize the demand covered subject to a limit on the number of open facilities.

The second section addresses special models in location theory, particularly competitive location. Chapter 7, which looks at the situation where competitors locate simultaneously, seeks a Nash equilibrium. This line of research originates from the economist Hotelling. Conversely, Chapters 8 and 9, which assume that competitors locate in turn (sequentially), seek a von Stackelberg solution. Chapter 8 looks at the papers of Teitz and of Prescott and Visscher; Chapter 9 focuses on those of Drezner and Hakimi. In many applications, one seeks to locate facilities as close as possible to customers; this is not the case for undesirable facilities (e.g., rubbish dumps, prisons). Chapter 10 surveys the contributions to this research stream by Church and Garfinkel, who point out that these models can conversely be used to locate desirable facilities among undesirable

customers. Most location theory papers assume deterministic demands; however, demand is often probabilistic, leading to the topic of stochastic location. Chapter 11 points out that Frank's seminal work motivated this line of research. Chapter 12 surveys hub location, which assumes flow of goods among facilities and includes a discussion of O'Kelly's seminal paper.

The third section looks at five of the most common types of solution methods for location problems. Some are applicable to many problems; others are problem specific, but deserve mention because they are oriented toward important locational problems. Chapter 13 focuses on two problems solved by branch and bound: the quadratic assignment problem as solved by Gavett and Plyter and the uncapacitated facility location problem as solved by Efroymson and Ray. Although branch and bound is a general type of solution method, developing problem-specific techniques is worthwhile for many location problems. One such class of problems is location on trees (or similar structures), where the structure can be exploited. Chapter 14 surveys three papers on this topic; it notes that although Goldman's work is well known to location theorists, others might have been overlooked because location is not their main focus: Harary and Norman worked on pure graph theory and Hua's paper addresses wheat harvesting. Chapter 15 presents both classical heuristics (those of Cooper, Maranzana's alternating heuristic, and the Teitz–Bart method) and briefly surveys today's heuristics and metaheuristics, techniques that have recently developed rapidly in OR. Although Chapter 16, the Weiszfeld method, has the narrowest focus (it looks at a single algorithm), it deserves a full chapter! The final chapter of this part (Chapter 17) also deals with a general technique, Lagrangean relaxation, discussing the works of Bilde, Krarup, Diehr, and Marsten, and their impact. Although the entire book is eminently readable and enjoyable, I particularly praise this chapter, which shows the succinct style and attention to detail of the late Roberto Galvão, who contributed significantly to location theory and vehicle routing.

The final section discusses the allocation of customers to located facilities, a necessary complement to facility location. Chapter 18 surveys gravity models,

including the seminal works of the geographers Reilly and Huff. Chapter 19 introduces Voronoi diagrams and shows their place in location theory. It highlights the work of the geographer Thiessen (rather than that of the mathematician Voronoi), which is more appropriate for a book on location theory. Chapter 20 looks at why specific economic activities are located in specific places, discussing the works of von Thünen, Christaller, and Lösch. It also describes the impact these works had on regional planning, especially in Germany.

Although this long list of topics would appear to provide comprehensive coverage of locational analysis, some areas are missing. For example, the book looks only at locating point-like facilities (except to some extent in Chapter 20). However, quite a body of literature addresses problems where a facility's size is significant compared to facility-to-customer distances. Perhaps because it is a more novel area than those surveyed, it might not be classified as "foundation"; to those interested in the location of extensive facilities, I recommend Díaz-Báñez et al. (2004). Location-routing also has a long history; Rand (1976) recognized that omitting vehicle routing aspects from locational decisions can lead eventually to increased costs. Location-routing considers routing costs (for which the sum of depot-to-customer distances is a poor proxy), even if they are changeable and hard to estimate for the duration of the facilities located. I regret that this aspect is missing from the book (although Chapter 15 surveys Maranzana's early contribution, its connection to location-routing is not mentioned). Nagy and Salhi (2007) survey this area.

Without hesitation, I recommend this book to all location theory researchers. PhD researchers will find it useful for understanding the origins of our field. Established researchers should be interested in its collection of the seminal works that shaped location theory. Finally, I hope it gives readers a desire to read the original works!

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TALBI, EL-GHAZALI. 2009. *Metaheuristics: From Design to Implementation*. Wiley, Hoboken, NJ. 593 pp. \$121.00.

Metaheuristics are among the most interesting topics in operations research and computer science today. They have had a major role in resolving many challenging combinatorial optimization problems and in providing practical solutions that aid decision makers. Metaheuristics are usually created by several researchers and often require extensive validation and benchmarking, processes that can take years. Fred Glover coined the metaheuristics term in 1986 (Gendreau and Potvin 2010); however, many other algorithms (i.e., heuristics) have preceded these new types of procedures. Talbi's book contributes to the literature on these metaheuristic techniques by classifying them, organizing them, and explaining in detail their main traits and characteristics. Several handbooks that provide reviews of these techniques have been written recently; examples include Gonzalez (2007) and Gendreau and Potvin (2010). However, for the student who is working with these methods for the first time, Talbi's book makes metaheuristics and their implementation within applications more understandable.

Metaheuristics: From Design to Implementation makes significant contributions to the metaheuristics literature. It clearly explains difficult terms and algorithms, making it suitable for use in teaching students in graduate and PhD programs. It presents a unified picture of all the metaheuristics families, highlighting the main virtues of their designs and the results achieved when they are implemented. It gives readers from many application fields, including logistics and transportation, scheduling, engineering design, marketing decision making, and bioinformatics, the skills to solve large-scale problems quickly and efficiently. In addition, it can help them to understand the design of hybrid, parallel, and distributed metaheuristics in classical and multicriteria optimization

problems. Hybrid metaheuristics enhance traditional metaheuristics to overcome the performance of traditional algorithms in solving large-scale problems (Brum et al. 2010, Montoya-Torres et al. 2011).

The book is organized into six chapters, which are preceded by preface, acknowledgments, and glossary sections and followed by appendix, references, and index sections. Chapters 1, 2, and 3, which are interrelated, include a general description of metaheuristics techniques and an excellent introduction to using them. Chapter 1 introduces the common concepts of metaheuristics in a very clear way, making it useful for practitioners who want to design new algorithms. Topics covered include quality of solutions, computational efforts, robustness, statistical analysis, and software frameworks for metaheuristics. Chapter 2 presents a unified view of the single-solution based metaheuristics (i.e., *S*-metaheuristics), including the common search components for this method, the concept of large neighborhoods, and the landscape analysis of optimization problems. It also introduces most of the well-known *S*-metaheuristics, including simulated annealing, local search, tabu search, and GRASP. Chapter 3 addresses population-based metaheuristics (i.e., *P*-metaheuristics), including a generic introduction to this type of procedure and a discussion of some of the most popular *P*-metaheuristics: genetic algorithms, evolutionary methods, scatter search and path relinking, swarm intelligence algorithms (i.e., ant and bee colonies methods), and some artificial immune systems.

Chapters 4, 5, and 6, which can be read as independent chapters, address applications of metaheuristics in different fields. Chapter 4 describes the use of metaheuristics in multiobjective optimization. Chapter 5 focuses on the description of hybrid metaheuristics, their classification, and their applications in real-world problems. Chapter 6 explains parallel metaheuristics and methods designed to improve their performance. Each chapter ends with a list of exercises to help the reader put into practice the chapter's contents. A short appendix gives an overview of UML and C++. A list of 847 references, the book's real treasure trove, concludes this work. The number of references shows the exceptional effort the author made to provide suitable

papers, books, and material to clarify difficult concepts. To supplement his book, the author has also created a webpage (<http://paradiseo.gforge.inria.fr/>) with metaheuristics-related material (e.g., exercises, tutorials, and examples) to help the reader understand the best ways of implementing metaheuristics procedures to solve problems.

This book has a large potential audience: professors, researchers, practitioners, and PhD and graduate students in diverse fields such as computer science, operations research, management science, business and management, engineering, and marketing. Researchers and professors can benefit from the book's thorough exposition of metaheuristics algorithms and their hybrid procedures linked to the resolution of many practical problems. Students and practitioners can gain knowledge about applications of the methods and their performance in actual cases. Practitioners and researchers who need a theoretical and practical knowledge in the design of new algorithms will find it to be a good addition to their libraries.

In conclusion, I found reading *Metaheuristics: From Design to Implementation* to be pleasant and enjoyable. I particularly recommend it as a reference for researchers and students of computer science or operations research who want a global outlook of metaheuristics methods. It would also be extremely useful for introducing graduate and PhD students who are new to the field of heuristics and metaheuristics to the amazing world of the designing of these procedures.

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YIN, YONG, IKOU KAKU, JIAFU TANG, JIANMING ZHU. 2011. *Data Mining: Concepts, Methods*

and Applications in Management and Engineering Design. Springer, Heidelberg, Germany. 312 pp. \$179.00.

Data mining (DM) can be described as a tool set for, or process of, discovering knowledge (more or less automatically) from observational data sets. It is interdisciplinary in that it combines concepts and approaches from fields that include database technology, machine learning, statistics, data visualization, pattern recognition, and optimization. The progressive gathering of very large and heterogeneous data sets, accompanied by the increasing computational power and evolving database technologies, has generated an increasing interest in DM. In addition to technological advances, the success of DM—at least in corporate environments—can also be attributed to changes in the business environment. Many factors have created a need on the part of these companies for enhanced insight, understanding, and actionable plans that allow them to systematically manage and deepen customer relationships. These factors include increased competition because of the advent of electronic commerce, removal of barriers for new market entrants, more informed and thus demanding customers, and increased saturation in many markets. Insurance companies try to identify those individuals who are most likely to purchase additional policies, retailers seek those customers who are most likely to respond to marketing activities, and banks want to determine the creditworthiness of new customers to offer them attractive products. These organizations also try to improve their churn prediction performance using data-driven methods.

The book has 14 chapters, effectively divided into two parts. The first part (Chapters 1–6) provides an introduction to DM methods; the second part (Chapters 7–14) has examples of DM applications in the areas of management and industrial engineering.

The first chapter provides a brief introduction to two simple and widely used methods. Decision analysis is exemplified by the well-known concept of a decision tree. For cluster analysis, it demonstrates three algorithms (single, complete, and average linkage clustering). The second chapter illustrates the technique of association rule mining and the basic Apriori algorithm for searching frequent itemsets in large databases as a basis for discovering relationships or correlations among a set of objects. The objective of Chapter 3 is to provide some terminology and

the basic theory of fuzzy modelling and fuzzy optimization methods that help decision makers to cope with typically nondeterministic real-world situations. Chapter 4 reviews a quadratic programming problem with fuzzy objective and resource constraints and discusses genetic algorithms and symmetric and non-symmetric nonlinear problems. Neural networks and in particular the fundamental self-organizing maps (SOM) are addressed in Chapter 5. Chapter 6 focuses on privacy-preserving DM. The challenge is to analyze (sensitive) data but also consider privacy rights.

Chapter 7 addresses supply chain design by applying decision analysis to investigate conditions under which the leader of a supply chain should implement policies such as cooperation and leadership. Chapter 8 describes the application of a decision tree. The tool is used to gain insights into the impact of product global performance on the choice of product architecture. Chapter 9 examines the application of cluster analysis to cellular manufacturing. Using nine performance measures, it compares the performance of various well-known similarity coefficients in an experimental setting comprising more than 200 numerical cell formation problems selected from the literature. Chapter 10 considers a similar application area by focusing on manufacturing cell design by cluster analysis. It emphasizes that the introduced cell formation problem incorporates actual production factors simultaneously (e.g., alternative process routing, operation sequence and time, machine characteristics). In Chapter 11, a fuzzy modelling approach and a genetic-based interactive approach for quality function deployment-based product planning are proposed. Chapter 12 describes an approach for inventory classification based on association rules. It presents results of empirical experiments to show that the proposed method is more effective than the traditional ABC classification. Chapter 13 introduces a SOM-based approach for generating reference data for automatic exterior inspection within an assembly line in the electronic device industry. It also proposes an indicator for evaluating the learning effect. The last chapter, Chapter 14, addresses the application and evaluation of privacy-preserving clustering, and collaborative DM.

The book is a combination of a textbook and a collection of papers. Although I like the concept of combining theory and the description of real-world applications, I am not fully convinced of its value in this book. I am not saying that such a combination cannot be useful or that the book's chapters are difficult to follow. However, this book does not seem to successfully accomplish the blending. Its general structure and the structure of the individual chapters are sometimes disappointing. In my view, a first chapter introducing the general framework of DM and the process of knowledge discovery in databases would be useful for the novice reader. Understanding the context of DM would make the subsequent chapters easier to understand, particularly because DM is more than just a standard cluster analysis or application of a neural network. The lack of a clear definition of DM with its processes and building blocks might confuse the reader of Chapters 3 and 11. My major concern is that the relationship between fuzzy modelling and optimization and DM is not clear. The book should include more convincing examples of DM methods and successful real-world DM applications. A minor concern is that the writing style is sometimes inconsistent among the chapters (e.g., with respect to using abbreviations).

Some case studies are not as illustrative as expected or possible. Presenting theory in one part of the book and applications in the second part is a laudable objective; however, because the theoretical part includes examples and the second part also includes some theory, the book's partitioning is not realized. In some cases, the same topics (e.g., support and confidence framework related to association rule mining) are described twice. Although this enables the reader to move from theory into an associated application-oriented chapter, the reader who starts at the beginning might not find the repetitions to be interesting or useful.

The book's strength is its consideration of some important parts of DM, both in theory and in applications. Its weakness is in it how it unifies (or does not unify) the chapters and how it presents some topics. It is not intended for DM experts who should

already be familiar with the proposed approaches and results. It could prove useful for industrial and managerial practitioners who want to understand DM-related methods and how they could use DM to support their decisions. Beginning researchers might also benefit because the book reflects the diversity of DM methods without providing complex details of the algorithms. People who want to understand DM basic concepts or to learn more about diverse DM instruments, but who have no background in information

systems, decision support, or DM, should first read a comprehensive textbook.

My hope is that this book will inspire and motivate decision makers to consider DM as a useful approach for solving some decision problems.

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