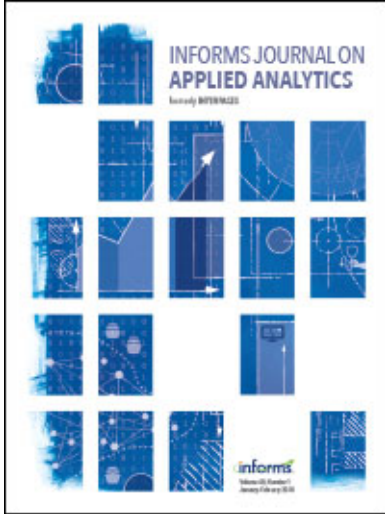




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## Book Reviews

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## Book Reviews

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**Abstract.** 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*, 47(1), January–February 2017: *Decision Science for Housing and Community Development: Localized and Evidence-Based Responses to Distressed Housing and Blighted Communities*, Michael P. Johnson, Jeffrey M. Keisler, Senay Solak, David A. Turcotte, Armagan Bayram, and Rachel Bogardus Drew; *Linear and Mixed Integer Programming for Portfolio Optimization*, Renata Mansini, Włodzisław Gryczak, and M. Grazia Speranza.

JOHNSON, MICHAEL P., JEFFREY M. KEISLER, SENAY SOLAK, DAVID A. TURCOTTE, ARMAGAN BAYRAM, RACHEL BOGARDUS DREW. 2015. *Decision Science for Housing and Community Development: Localized and Evidence-Based Responses to Distressed Housing and Blighted Communities*. John Wiley & Sons. 416 pp. \$115.00

Within academia and especially within the field of operations research, we search for the best quantitative and mathematical solutions to problems, and we seek to develop and integrate creative new insights into our algorithms and solution procedures. In these efforts, we are academics and scientists who are working to solve problems. Many times, from business, industrial engineering, or economic perspectives, our goals are to focus on cost, revenue, and profit, which are important goals and reasons for modeling. However, as academic operations researchers and management scientists, we can and do contribute more broadly to our world and society.

Shifting to important and broader contributions requires further development of humanistic and socially conscious, compassionate research (Sarkis 2012). Although compassionate research has always existed, its necessity is greater today than at any

time in our history. The use of modern technology and techniques in developed regions of the world allows us to realize the highest quality of life ever recorded; however, social and environmental problems have not disappeared. Arguably, the stresses on our global resources and social structures are also at a historic peak. These relationships and complexities have resulted in extensive socially wicked problems (Churchman 1967). Wicked problems are complex, intractable, conflicting, multidimensional problems that frequently have unforeseen and unintended consequences. For example, gentrification helps blighted communities; however, it also causes the displacement of community members who cannot afford these gentrified communities. In addition, poverty alleviation through economic growth may cause significant environmental damage, as we have seen in China.

These issues and forces have culminated in the growth of compassionate operations research to help tackle these wicked problems Brandenburg et al. (2014).

Social and environmental sustainability and development have become integral aspects of the business and industrial research vernacular. Research on topics such as poverty alleviation, humanitarian logistics

and planning, greening of industry and supply chains, human trafficking, social equity, and community development, to name a few, has grown. The disciplines that utilize the models, theories, and tools from our operations research and management sciences community have also expanded. Our toolsets and knowledge are flexible and pervasive. Dare we say, they offer the world solutions to solve some of our most pernicious, wicked problems.

Churchman (1967), in introducing wicked problems, establishes a moral principal for the operations research and management science profession and community. The moral principle is this: “whoever attempts to tame a part of a wicked problem, but not the whole, is morally wrong” (p. B-142).

It is within this broader context and perspective that Johnson, Keisler, Solak, Turcotte, Bayram, and Drew seek to address wicked problems related to distressed housing and blighted communities in *Decision Science for Housing and Community Development*. A book describing and evaluating the many issues, perspectives, and tools needed for this wicked problem is a step toward addressing the moral principle—this necessary holistic taming of the problem. The authors demonstrate how the application of various analytical tools from operations research and decision sciences can be used to empower community-based applications, particularly in the sector of urban housing and community development.

The authors point out that this book’s origins include the most recent and tenacious 2008 economic recession from which we had not fully rebounded eight years later. This recession has been closely tied to the subprime mortgage crisis that began in 2007 (Johnson and Neave 2007) and left many communities replete with foreclosed homes.

The problems discussed in this book have many dimensions and factors that can influence decision making. The authors use the term community-based operations research (CBOR) to help bound and define their work, which originated in Johnson (2012), the lead author’s previous work. We believe that this may be a growing field in the broader compassionate operations research topical disciplines. In the foreword, Joseph Ferriera explicitly uses the term “wicked problems.” This is the term we immediately gravitated toward when we saw “blighted communities” in the

subtitle of the book. It is one time when we were able to partially judge a book by its cover.

The book’s six authors are from different schools and have different backgrounds, although the nexus of their work and backgrounds is analytical operations research. Their backgrounds, which are in different social sciences, urban planning, and business disciplines (they make this observation in the book), complement one another. Their perspectives permeate the book’s 11 chapters.

Unlike traditional applications that focus on cost minimization, multiple stakeholders are involved in these contexts. Therefore, an important contribution is the rich exploration of the multiple-objective nature that frequently appears in public sector problems with their many stakeholders.

More than developing and solving stylized models, this book focuses more on obtaining meaningful results that impact society. The authors use analytical methods not to find a single best outcome, but rather to derive insights into the context that can enable key urban decision makers to make better choices. Hence, they attack the domain of foreclosed housing acquisition and redevelopment by drawing from the rich supply of operations research techniques. These range from qualitative, decision analysis-based approaches, to quantitative methods, such as mathematical programming and dynamic programming.

The authors champion the use of advanced analytical techniques in the public sector, a practice that is sorely needed. They present in-depth case studies that offer practical insights into the realities and challenges of managing urban housing. This book would be an excellent textbook for students who want to learn more about community-based operations research and are in advanced undergraduate or early graduate classes on the topic.

If courses are to be developed with CBOR as the central theme, this book might be one of the required readings. At this time, we feel that it is valuable as a compendium of stand-alone case studies that can be used in a classroom discussion.

At our institution, Worcester Polytechnic Institute, this book can be a valuable reference for our project-based education system at the undergraduate level. Our project-based education allows a team of students

to focus on a particular problem over a term, or multiple terms, during a semester for course credit (three courses worth of credit). The book's cases and tools provide a wonderful reference for the broad spectrum of analytical tools available for students. One of the authors of this book review addressed one CBOR issue on a sustainable development project in Paraguay. We mention this example and project because such communities exist throughout the world and organizations to help these communities are in most developed countries, such as the United States, or in developing economies, such as in Paraguay.

Overall, the introductory sections provide a background and history of the various social issues and ills associated with urban crisis and sets an excellent foundation for the analytical models introduced later. We believe that the book contributes and advances CBOR, a topic that is meant to assist our most vulnerable regions and population, and we hope to see more topics related to this field in the future. It is also a step in the direction of morally addressing this wicked problem.

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MANSINI, RENATA, WŁODZIMIERZ OGRYCZAK, M. GRAZIA SPERANZA. 2015. *Linear and Mixed Integer Programming for Portfolio Optimization*. Springer. 119 pp. \$69.99.

The audience for a book on portfolio optimization, which can range from investment consultants

to theoreticians in mathematical statistic, is potentially very broad. Therefore, we should expect that a review of such a book will address the benefits that most of that broad audience will accrue from reading it. On the book's back cover, the authors claim that this book is "thoroughly didactic," and requires "no background in finance or in portfolio optimization." Indeed, the material focuses on the various linear programming and mixed-integer linear programming problems that can be interpreted in terms of portfolio selection. Therefore, it would seem to be most suitable as a complement to lecture notes in a graduate course on applied optimization, because the computational aspects of portfolio optimization presented are among the most active research directions. The methods of linear and mixed-integer linear programming that the book considers are also applicable to various problems outside the field of finance, such as in business and engineering.

In this book, which consists of seven chapters, the stochastic programming methods address the single-period portfolio optimization with linear models of risk, rebalancing, and index tracing. The introductory chapter, *Portfolio Optimization*, explains the concept of portfolio selection, including the trade-off between the basic objectives: return and risk. After explaining the concept in economic terms, the authors mathematically present it by using the classical Markowitz model. In Chapter 2, *Linear Models for Portfolio Optimization*, which is the longest chapter, they discuss computational disadvantages of the Markowitz model and options for mitigating these disadvantages, for example, by replacing the quadratic risk model by a linear model. If we assume the scenario model of uncertainty, replacing the classical quadratic programming model with a linear programming model is possible. Such a replacement is important for various applications because the linear programming solvers that are available are more reliable than quadratic programming solvers, and can solve much larger problem instances within any given time. In this chapter, they also present mathematical formulations of major relevant problems, including the selection of portfolios that are optimal with respect to various risk measures, such as mean absolute deviation and conditional value at risk. However, practical investments are complicated by other costs and restrictions not included in the basic model of portfolio selection.

In Chapter 3, *Portfolio Optimization with Transaction Costs*, the authors consider various structures of the transaction costs. Although portfolio selection models with transaction costs are more realistic than the basic ones, the literature on the former is scarce. In this chapter, main models formulated as mixed-integer linear programs are presented. The complication of computation caused by the transaction costs is essential; for example, finding a feasible solution to the portfolio optimization problem with the fixed costs is NP-complete. The additional complications of the portfolio selection model are considered in Chapter 4, *Portfolio Optimization with Other Real Features*; real features refer to the restrictions an investor may be obliged to keep, for example, the transaction lots, the thresholds of investment, the cardinality constraints, and the decision-dependent constraints. All these restrictions can be added to the models developed earlier. In Chapter 5, *Rebalancing and Index Tracking*, the developed models are reformulated; the authors assume that an investor who is considering an investment problem already owns a portfolio of assets and

is considering adapting it to changing conditions (e.g., to changes in the market). They present mixed-integer linear programs and describe the problems of portfolio rebalancing, market index tracking, and the use of short positions in a portfolio. In Chapter 6, *Theoretical Framework*, which is a 10-page chapter, they briefly discuss the theoretical concepts of tackling uncertainty, such as risk-averse preferences, stochastic dominance, and coherent risk measures. Chapter 7, *Computational Issues*, includes a discussion of computational issues, such as linear programming and mixed-integer linear programming solvers and the kernel search, which is a general heuristic. It also provides some observations on testing the algorithms discussed.

*Linear and Mixed Integer Programming for Portfolio Optimization* was written by experts who are well recognized in their field, and I believe it is suitable for use as a textbook on the computational issues of portfolio optimization.

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