



Interfaces

Publication details, including instructions for authors and subscription information:
<http://pubsonline.informs.org>

Book Reviews

To cite this article:

(1988) Book Reviews. Interfaces 18(5):92-102. <https://doi.org/10.1287/inte.18.5.92>

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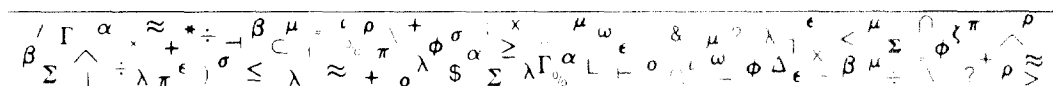


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Book Reviews

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The range of books reviewed is wide, covering theory and applications in operations research, statistics, econometrics, mathematics, computers, and information systems. In addition, we include books in other fields that emphasize technical applications. We list the books and proceedings received; not all books received can be reviewed because space and time are limited. Those who would like to review books are urged to send the editor their names, addresses, and specific areas of expertise. The editor commissions all reviews and does not accept unsolicited book reviews. Readers are encouraged to suggest books that might be reviewed or to ask publishers to send copies of such books to the editor.

MURTHY, T. K. S.; LAWRENCE, L. S.; AND RIVIER, R. E., eds. 1987, *Computers in Railway Management*, Springer-Verlag, New York, 224 pp., \$99.40.

This book contains some of the papers presented in the First International Conference on Computer Aided Design, Manufacture and Operation in the Railway, and other Advanced Mass Transit Systems (COMPRAIL87). The purpose of these papers is to report the advantages, uses, and potentials of computer aided systems in railway management. Transportation system analysts and engineers

would find this book useful. Readers not familiar with railway operations but interested in computer applications may find several papers that describe general system planning methodologies useful.

Section 1, planning and management, includes 13 papers covering diverse management functions, such as planning and design of networks, financial systems, traffic forecasting, maintenance of train and track, and train scheduling. The methodologies and technologies used include system modeling, decision support

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0091-2102/88/1805/0092\$01.25

INTERFACES 18: 5 September-October 1988 (pp. 92-102)

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systems, simulation, hardware systems, and computer integrated manufacturing. Section 2, information systems, includes five papers on management information systems in the railway industry. The functional areas covered are track maintenance, automated control, passenger information, and computer aided design (CAD).

This book is a good collection on current work and trends of railway management. It is aimed solely toward people who are highly interested and involved in planning computerized railway management.

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STARFIELD, A. M. AND BLELOCH, A. L. 1986, *Building Models for Conservation and Wildlife Management*, Macmillan, New York, 304 pp., \$35.00.

This book deals with problems in the area of conservation and wildlife management, and attempts to preserve a proper balance between different animal species and vegetation using real and hypothetical case histories from Africa. These problems are unstructured and information is insufficient. The main thrust of the book is to show how models and mathematical and computational techniques can be used to support decisions in that framework. The approach proposed is based on trying to decompose the ecosystem, which is rather complex, into basic components to address specific management problems or concerns (for example, the decline in the population of a species). Then, very simple and approximate

models are built, based on whatever data are available. The results are analyzed to check their consistency with reality (known or estimated data) and common sense (qualitative properties). Since a first approximation may not be satisfactory, the model can be reformulated and possibly new data may be gathered. This iterative and learning process allows one to explore in a realistic way different explanations for behavior patterns.

The problems covered include the study of population patterns of zebra, wildebeest, roan, and lions, growth of vegetation, and the interaction between several species of animals and the vegetation which feeds them.

Each study analyzes a very small number of primary explanatory variables and suggests general courses of action.

Typical management actions proposed are predator control and improving the quality of the habitat to protect some animal species, and animal cropping to preserve a proper animal-vegetation balance. In some cases, the analysis led to interesting though not conclusive results. For example, variations in roan population could be modeled in a simplified way based on social behavior, reproduction, and rainfall patterns. Simulation tests led to two basic population growth modes: accelerated and stalled, depending on exogenous conditions. However, lack of data made it difficult to justify some of the assumptions, and the results obtained and the best courses of action proposed could be verified only in a general, qualitative way.

The main techniques proposed for dealing with the different problems are deter-

ministic and stochastic simulation, differential equations, regressions, linear programming, and simple expert systems.

The book is easy and fun to read, and it assumes no advanced mathematical knowledge. It will interest chiefly practitioners in wildlife management; it offers a novel and practical approach to model building and problem solving. Useful references are given for each subject. The pragmatic way suggested for dealing with unstructured and data-poor problems could interest general OR practitioners. The main drawback of the material presented is that validation with respect to reality of the proposed models is generally weak. In some cases, such as the presentation on an expert systems approach, the problems analyzed are illustrative, not realistic.

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ALBRIGHT, S. CHRISTIAN 1987, *Statistics for Business and Economics*, Macmillan, New York, 1012 pp., \$42.75.

This text is intended for a two-semester introductory sequence in statistics for either undergraduate or graduate majors in business or economics. In mathematical sophistication, the book falls between Wonnacott and Wonnacott [1984] on the high end and Iman and Conover [1983] on the low end and is comparable to Daniel and Terrell [1986]. More detailed mathematical developments are generally confined to appendices.

In evaluating a text aimed at this market, I feel several issues must be ade-

quately addressed. These issues include the stress on probability throughout, an algorithmic approach to hypothesis testing, graphical communication and summary of concepts and information, the integration of computer-based data analysis, relevant and timely applications, graduated difficulty of problems within sets, and an emphasis on data analysis with an eye ever toward interpretation and implications. Apart from its coverage of graphic analysis, which is ordinary at best, this is a well-written text which compares favorably with those mentioned above. The text strongly merits consideration for adoption for the targeted two-course sequence.

Albright succeeds in stressing the probabilistic foundations of statistical evidence and inference throughout the text. An unusual and useful addition to the typical array of tables of probability distributions is the inverse normal table provided on the front inside cover. One weak point is that the book fails to provide limits for both the binomial and hypergeometric distributions.

The author emphasizes an algorithmic approach to hypothesis testing and uses the same series of steps in virtually every hypothesis-testing application in the text, ranging from tests of a population mean to tests of regression coefficients. The role that power plays in determining sample sizes is appropriately emphasized. In covering the F -test for the equality of two variances, Albright fails to emphasize that the ratio $F = S_1^2/S_2^2$ has been artificially constructed so that S_1^2 is the larger of the two sample variances; he rather casually suggests this earlier in the text when he

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discusses a confidence interval for σ_1^2/σ_2^2 . In addition, he gives no indication that the significance level of this F -test is 2α rather than α .

Overall the book has a mixture of strengths and weaknesses, with strengths far exceeding weaknesses. Albright carefully develops analysis of variance and regression methods and covers them in a particularly thorough way for a text of this sort. He emphasizes generalizability of methods and presents a variety of applications, including some in quality control, queuing, inventory, consumer protection, and materials requirements planning. Problem sets are particularly good and are of graduated difficulty within sets. Many problems start with the data to be analyzed. Problems that reinforce a "statistics is useless" attitude are avoided. Many of the problems, examples, and applications are related to quality control, and an interested instructor could emphasize this area of rapidly increasing application and importance. Unfortunately, Albright missed a fine opportunity to include a chapter on quality control similar to the one in Daniel and Terrell [1986].

Albright emphasizes computer usage in data analysis throughout the book without compromising the technique in question. The IDA microcomputer package is available to instructors using the text, and the disks are not copy-protected. This package is available for either the IBM-PC and PC-compatibles or the Apple II family of microcomputers. Mainframe output from the SPSS package is also included in the text. The author does an outstanding job of emphasizing interpretation of out-

put from the IDA and SPSS packages without marrying the text to these packages.

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DEAN, BURTON V. 1985, *Project Management: Methods and Studies*, North Holland Publishing Company, New York, 318 pp., \$50.50.

This is a collection of 18 papers that are organized into four major parts. Each chapter (paper) is written by different authors and contains a short abstract explaining its contents. The book was developed based on a call for papers. According to the editor, the book is intended for three types of readers: functional managers and executives who support or manage projects, graduate students who are interested in studying the contributions of management science to project management, and management scientists interested in project management research.

Part 1 contains four papers on project evaluation and selection. The papers concern strategic evaluation of projects, a portfolio model using multi-attribute utility theory, decision analysis for evaluating

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new processes, and an aggregate model for multi-project resource allocation.

Part 2 presents papers on scheduling and control. These papers concern precedence diagramming, the many alternative models for project planning control, an empirical study of critical factors for deciding when to terminate a project, and the use of goal programming in handling multi-objectives in project planning.

Part 3 is titled human resource management. The papers cover an approach to R & D project selection that recognizes the behavior of the participants, a study of how network techniques can be used for team building, a presentation of conceptual models for technology transfer across functional area, and a discussion of an in-house training for the Allen-Bradley company on project management.

The final part of the book presents four papers on applications and studies in project management, the last being a survey of the research on project management from 1976 to 1983.

I believe the book could be useful to the targeted audiences. It is one of the few sources that updates information on the development and use of management science techniques in project management.

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PHILIPOSE, SUSY 1986, *Operations Research: A Practical Approach*, Tata McGraw-Hill Publishing Company, New Delhi, India, 416 pp., Rs 120.00.

This textbook contains the standard

fare for an introduction to operations research. Its two distinguishing features are that its only prerequisite is a high school level understanding of mathematics and that it includes 10 case studies at the end of the book.

Philipose attempts to minimize the mathematical jargon; however, several chapters contain concepts from calculus (integrals) and mathematical notation. The 10 case studies are more like big problems. They offer students the opportunity to apply OR techniques to problems within the book which are described as occurring in business settings. While the problems are reasonably practical, they do not use real data or refer to real companies.

I am not optimistic that most faculty members would find anything in this text to cause them to abandon any of the more popular introductory books in OR.

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BRAMS, STEVEN J. 1985, *Superpower Games*, Yale University Press, New Haven, Connecticut, xvi + 176 pp., \$7.95 paper, \$22.50 hardcover.

Models, simulations, and games (MSG), such as iconic figures, sand tables, field exercises, and chess-like game boards to represent warfare, predate recorded history. However, academics took little interest in MSG standardization or research until professional military colleges were established in the 18th century. In addition to developing engineering curricula for the design of the

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implements of warfare, they paid increased attention to war-gaming. The German "Kriegsspiel" (1811) marked the beginning of large complex manual games using maps and rules based on actual operational doctrine. From the Franco-Prussian War throughout World War II, every major military power relied heavily on institutionalized manual war games for force planning, training, doctrine development, and evaluation of war plans.

After World War II, the advent of electronic computers and of nuclear weapons had a significant impact on war-gaming activities. Computer-based MSG generically related to historical manual games and data bases proliferated; they were concerned principally with understanding conventional warfare. With no historical data or experience in nuclear warfare, many analysts in civilian-directed think tanks, such as the RAND Corporation, questioned the utility of large complex computer-based war games. Primarily concerned with the political and strategic aspects of nuclear war, they sought to develop more rigorous mathematical foundations. After World War I, Lanchester investigated the rise of differential equations in calculating combat casualties in conventional combat, but not until the 1950s did a formal mathematical modeling structure for game theory begin to develop. These models treat competitive or cooperative situations involving two or more players whose interests are pursued through a variety of strategies and whose gains and losses can often be calculated in terms of outcome or payoff matrices. Game theory provides a simplistic, rational, dispassionate method of examin-

ing the political behavior of nations, particularly the United States and the Soviet Union in a strategic nuclear exchange. Since the McNamara era, it has provided information for the concept of nuclear deterrence and the national policy of mutual assured destruction (MAD).

Brams's book provides an excellent primer for the mathematically oriented reader interested in the historical development of games theory and its application to superpower conflict; it ranges from the classical work of von Neuman and Morgenstern in the 1950s to the state of the art in the mid-1980s. Brams has included a complete glossary of technical terms that describe new game-theoretic concepts, and throughout the book, he attempts to demonstrate their applicability to different Soviet-American conflicts. He has categorized games into three different sets: deterrence, arms-race, and verifications. His chapters on arms-race and verification games are primarily untested theoretical mathematical constructs. However, his discussion of deterrence games and their application, using historical data from the 1962 Cuban missile crises and the 1973 Yom Kippur War, makes a significant contribution to the practical utility and validation of game-theoretical models. In addition, Brams has attempted to expand static classical game theory to a sequential, dynamic model.

Overall Brams accomplishes his objective to promote normative analysis of superpower conflict in lieu of abstract deductive, rational-choice models for use in pure scientific inquiry. However, his bibliography and list of references are

extremely restricted and generally limited to a small part of the total multidiscipline MSG literature related to understanding and controlling warfare. Those interested in the whole range of war-gaming activities from analytical games and computer aided games to field exercises might begin with the references listed here.

Brams's book and those referenced [Brewer and Shubik 1979; Callahan 1982, 1984] all point to the need to develop a multidisciplinary modeling language in understanding and controlling armed forces in peace and war. Paraphrasing Edward Teller on the control of nuclear weapons, "We must develop common MSG to communicate across academic disciplines and with our enemies, and to serve as a foundation for building physical systems with our allies."

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DAUGHETY, A. F. 1985, *Analytical Studies in Transport Economics*, Cambridge University Press, Cambridge, England, 253 + ix pp., \$44.50.

This book is an edited collection of eight articles written by some of the leading transportation economists in US academia on topics of current interest to that community. The papers deal primarily with surface freight transportation, except the last, which deals with passenger air transport. The first chapter is an overview by the editor, in which the material is appropriately cast as a contribution to the "application of microeconomic theory and analysis to issues and policies in the economics of transportation, via use of mathematical and statistical techniques." All the chapters are to some extent relevant to the issue of deregulation of transportation services, primarily in the US.

The material is generally of high quality, and each paper makes a nice contribution. Most are extensions of previous theoretical or methodological approaches applied to particular policy issues. Other than the editor's overview, only Friesz and Harker's discussion of methods for predicting equilibrium in freight networks has a substantial review component. One question is whether grouping the papers into a single volume adds anything. The answer is only a qualified yes. A well-printed hardbound collection conveys more of a sense of permanence and legitimacy than scattered journal articles. However, despite the editor's clear efforts to harmonize the contents and bring out unifying themes, no really compelling thread ties all the chapters together.

The chapters can be grouped into three areas: cost functions (supply), demand, and interactions (equilibrium, competition, pricing). The first topic is by far the best represented, comprising Chapters 2

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through 5, or about half the book. These papers fit together well, with a common theme, how to represent technology and network structure in econometric models of a transportation firm's cost structure. In Chapter 2, Friedlaender and Bruce examine the sources of productivity growth and technical change in the trucking industry as it existed in the regulated environment of the mid to late 1970s. Daughety et al., in Chapter 3, also present an econometric analysis of the technology of the trucking industry, this time in the 1950s, which appears to have been the last period of technological and regulatory stability in the industry. The next chapter, by Caves, et al. focuses on capturing network effects in cost functions for US railroads. Spady gives a more fundamental treatment of modeling network structure in Chapter 5, which does not have an empirical component.

This collection will prove valuable to researchers interested in the state of the art in cost functions specification and estimation. It would have been more complete if the work of Jara-Diaz on multiproduct transportation cost functions had been included. The collection could have been improved by explicitly contrasting the four chapters to each other, as well as to other approaches not included.

The remaining four chapters are much more heterogeneous, with little relation to the preceding four. McFadden, Winston, and Boersch-Supan present an econometric discrete/continuous model of shippers' joint decision of transport mode and shipment size derived from an inventory theoretic framework, not unlike that in the earlier work of Chiang. (Chiang's

work should have been included in the discussion of previous work.) An empirical realization is also presented for shippers of produce (seven commodities) in the US. That chapter is the only one that fits in the demand category. The next chapter is Friesz and Harker's review of methods for finding an equilibrium solution in freight networks, with particular emphasis on their own work. This is accompanied by an application to the US coal industry. The material in this paper relates rather weakly to the earlier papers, especially since solving actual large-scale networks typically necessitates making just the kinds of simplifications that are criticized in the previous papers. Unlike the other papers in this book, this one concerns algorithmic and computational considerations primarily.

Braeutigan devotes Chapter 8 to a mostly theoretical treatment of optimal pricing in a competitive market where all firms exhibit economies of scale, paying particular attention to the competition between rail and pipeline in the transport of coal. The last chapter by Call and Keeler deals with passenger air transport under deregulation. This is an extremely interesting, important, and timely topic, and the paper should be of value in the current policy debate. Its methodological component is less prominent than that in the other papers, though the policy relevance of the empirical analysis is clearer.

One of the book's objectives is to lower the cost of entry into the field to new researchers. Unfortunately, this objective is not likely to be achieved, because the book does not review and synthesize its subject thoroughly and stays within a

rather narrow area not likely to be accessible to neophytes. The author's principal audience consists of fellow transportation economists, who have a good grounding in the methodological issues of cost functions estimation and discrete choice analysis and solid mathematical training. Such readers may already be familiar with this material; much of it has been published in journals and conference proceedings. However, analytically-oriented economists and applied econometricians working in areas other than transportation may benefit from this collection. In particular, those concerned with regulatory questions in other sectors, such as telecommunications, that involve similar spatial considerations in a network context, could find the chapters dealing with cost functions useful.

Transportation professionals who have little knowledge of transportation economics and general MS/OR professionals will not find this collection useful. The book is intended mostly for researchers in universities, think tanks, or corporate research labs. Policy-makers do not stand a chance of understanding the book, though advisors with doctorates may find some useful material relating to policy (summarized in the editor's overview chapter). This book would also be a good reference for an advanced graduate course in transportation economics.

In summary, this is a high-quality collection of contributions to the methodology and theory of transportation economics. It would have been nice if the editor's overview had critically contrasted the methodological approaches and empirical findings presented in the

individual papers.

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LAWRENCE, K. D. AND ZANAKIS, S. H. 1984, *Production Planning and Scheduling: Mathematical Programming Applications*, Industrial Engineering and Management Press, 270 pp., \$29.95.

This book is an attempt to narrow the gap between general mathematical programming and applications in the field of production planning and scheduling. The book is divided into three sections. The first section gives a short overview of the general techniques of mathematical programming.

The second section describes the application of these techniques to production planning and scheduling. After two introductory chapters, papers published earlier by a variety of authors follow. The first six of these papers are written from a modeling point of view; the last six deal with experiences in practical applications.

The last section is concerned with production planning under multiple goals and objectives. Again a short summary of techniques is presented followed by six papers describing models and applications.

In the preface, the authors explain that their purpose is to present a comprehensive, integrated treatment of mathematical programming approaches in the fields of production planning and scheduling. Although the idea is very appealing and they have gathered a lot of information, I doubt whether the authors succeeded.

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For production planners with little background in mathematical programming, the short overviews of the general techniques will probably not be sufficient to make the papers on modeling and practical applications comprehensible. For mathematical programmers, these overviews will be of little value.

Missing is an overview of the fields of applications, which means that people looking for mathematical programming solutions for specific problems will have to survey the contents for papers concerning their subject. Consultants and OR practitioners (should) approach a production planning problem from a practical point of view, looking for an applicable mathematical programming technique after they have determined the exact outline of the problem. For these people, the book contains a lot of information, although it is not easily accessible.

The use of different variable names in the introduction and throughout the papers complicates reading. Different type fonts and the varying structures of the papers also confuse the reader. This does not mean that the book is of no interest for people familiar with mathematical programming. It gives a good insight in to the problem areas of production planning and scheduling in which mathematical programming can be applied. It can thus be an eye-opener for people studying this field or reviewing the methods and models currently used. An index by keywords would have been helpful.

In general, the book does not quite succeed in its purpose. The purpose could probably be better achieved by a complete structured book on production planning

that referred to the knowledge and results presented in the papers. This would prevent discrepancies in variable names and notation and make the book more comprehensible for readers not familiar with mathematical programming.

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