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The Analyst's Bookshelf

Reviews

GARY E. WHITEHOUSE, *Systems Analysis and Design Using Network Techniques*, Prentice-Hall, Englewood Cliffs, N.J., 1973, 500 pages, \$21.95.

THE BOOK represents an attempt to "demonstrate the advantages of using network modeling techniques for the analysis of systems." The motivation throughout is on the visual insight conveyed by a graphical representation of systems while no claim is made to its computational superiority to algebraic approaches. A good example of this is the book's use of flowgraphs for representing systems of linear equations by networks. Although it is unlikely one would solve large systems by flowgraphs, a flowgraph representation gives immediate insight into the underlying structure of the problem and allows a decomposition to local relations via MASON's Rule. In general, the book's emphasis is on predictive network models as opposed to the normative models more familiar to the operations research practitioner.

WHITEHOUSE has written the book in an eminently readable style. Complex mathematical notation is only used when verbal and graphical communication is not feasible. The reader is led by the hand through many of the network techniques. A good example is the presentation of the FORD-FULKERSON Max Flow Algorithm. A statement of the problem is given, followed by an explanation of why a naive approach will fail, a formal solution procedure accompanied by a detailed numerical example, and finally, a justification of the algorithm. An indirect approach like this sometimes leads to ambiguity, however, as in the statement of Mason's Rule.

The book's first chapter provides a short discussion of systems modeling by networks, and some of its advantages and disadvantages. Some good illustrations drawn from chapters to follow are included. Chapter 2 gives an adequate review of elementary probability theory including moment-generating functions and the Markov Property. Chapter 3 presents an excellent and unusually extensive discussion of the project network models PERT (Project Evaluation and Review Technique) and CPM (Critical Path Method). The method presented for calculating the critical path in PERT is by constructing early and late trees. A critical discussion of the assumptions inherent in PERT is included. A heuristic algorithm is presented for dealing with CPM in this chapter, leaving the out-of-kilter solution to a later chapter. Chapter 4 gives a detailed discussion of an application of CPM in a case study of marketing a new product.

Maximal flow and shortest path algorithms are described in Chapter 5 together with numerous applications (DIJKSTRAS' Algorithm is incorrectly suggested for use as a longest path algorithm). Some linear programming duality theory is touched on in explaining the out-of-kilter solution of the CPM problem of Chapter 3. The exposition would be extremely difficult to follow without prior acquaintance with linear programming. Flowgraphs are discussed in Chapter 6 including

several interesting economic applications. Chapter 7 takes an elementary look at decision trees. A solution by simulation is considered in addition to the standard dynamic programming approach.

The remainder of the book (almost half) deals with a stochastic network technique called GERT which was developed in 1966 by PRITSKER, HAPP, and WHITEHOUSE. GERT stands for Graphical Evaluation and Review Technique and is a generalization of PERT. GERT essentially corresponds to a graphic representation of semi-Markov processes which in turn shares the disadvantages previously cited about many graphical representations. Chapter 8 shows how to formulate problems as GERT networks and how to solve exclusive—or networks by Mason's Rule. Chapter 9 describes a simulation program GERTS III for solving general stochastic networks. Chapter 10 gives examples of applications of GERT to a number of disciplines including queuing theory and reliability theory. The final chapter illustrates real-life applications of GERT with four case studies.

Overall, the text is a well organized and broad introduction to the techniques of network analysis. Although the exercises are somewhat dry and unimaginative, the in text references are complete and extensive. The book is particularly recommended for the less technical courses where students require a high degree of practical motivation. The numerous case studies serve as no nonsense illustrations of how one might apply the techniques presented in the real world.

ROBERT L. SMITH
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V. M. RAO TUMMALA, *Decision Analysis with Business Applications*, Intext Educational Publishers, New York, N.Y., 1973, 578 pages, \$15.00.

COURSES in decision analysis seem destined to replace those that were formerly called by names such as "introduction to statistical methods," "statistical analysis," and other titles emphasizing the use of stochastic techniques. This text in decision analysis by PROFESSOR TUMMALA has embedded some very good introductory material in probability and statistics in a book to which other material has been added. This is not a bad idea if the student or reader is warned to recognize that he is getting an introductory survey to a class of tools that have varying degrees of usefulness in the solution of real business problems.

In spite of some of the reservations discussed below the text in general seems to be well written and is easy for a student with little or no mathematical background to understand. In my opinion the sections on probability and statistics are the best part of the book. I would highly recommend to Professor Tummala that he at some time consider a revised edition without Chapters 6 and 8 plus a chapter containing more of a discussion on the relative usefulness of certain methodologies for real decision making in business. Many of the methods are illustrated with flow designs. An Appendix of probability tables are included, as well as answers to selected questions.

The material (part of which presumably has already been tested on students) seems to be geared to the usual techniques that are now standard parts of many MBA programs. One of the difficulties that students can have with texts of this kind is that after learning an assortment of methods, they do not have any feel for the relative usefulness of these techniques in practical situations. Thus, for exam-

ple, in the chapter on decision analysis under uncertainty when the prior probability function is not known, decision criteria such as maximin, minimax, and minimax regret are elaborated upon in great detail. Although the difficulties with using some (not all) of these methods are pointed out, there is no evaluation of their practicality for real problems. When should one attempt to transform problems under uncertainty to those under risk by either employing subjective probability estimates or by spending additional resources to obtain information that can lead to prior probability distributions? Should one avoid doing so? Obviously, these questions are not clear cut and are extremely difficult to answer. On the other hand, without some discussion and evaluation of alternate approaches to such problems in a text designed to introduce nontheoreticians to quantitative decision techniques, the author is not being complete in the business applications aspects of the book. Similar comments apply regarding the subject of two-persons zero-sum games, which seems to have been included into the chapter discussed above because the author could find no other place. Another area where I felt that the treatment of the material could either have been more complete or left out entirely was the chapter on decision analysis under certainty. The practical usefulness of many certainty techniques can compare quite favorably with those based on uncertainty. However, here in 34 pages only, the two subjects of investment decision making and linear programming are discussed. No other decision problems under certainty (such as inventory models for example) are mentioned. In the section on investment decision making, there was no discussion of how to choose the interest rate in present value calculations, nor was there mention of the possible disadvantages of the rate of return such as nonuniqueness. In the linear programming section no mention is made of unboundedness or possible nonfeasibility of solutions and the simplex method is not illustrated.

I also felt that the material on an axiomatic development of utility and an axiomatic development of subjective probability (Chapter 6) while useful, is not really pertinent to much of the subject matter in the rest of the text. In fact, outside of Chapter 6, no mention is again made of either subject. In addition, the material appears to be at a somewhat more difficult level of reading than the rest of the book. Thus, it would seem that Chapter 6 could easily be omitted without any loss to the reader. However, as mentioned initially, the text could serve as an excellent basis for an introductory one-year course in probability and statistics.

SEYMOUR KAPLAN

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MYLES HOLLANDER and DOUGLAS A. WOLFE, *Nonparametric Statistical Methods*, John Wiley & Sons, New York, N.Y., 1973, 503 pages, \$18.95.

THE AUTHORS have done an excellent job in communicating to the scientist a broad spectrum of nonparametric statistical methods. The material, as presented, can be understood by the senior or first-year graduate student who has had an introductory course in statistics. Also, this book can be used by the practicing scientist as a short handbook of nonparametric methods.

Univariate methods are emphasized; however, univariate sequential methods and multivariate topics are excluded. Topics presented include hypothesis tests, point estimation, confidence intervals, and multiple comparison procedures. These topics are organized into the following chapters: Chapter 2, The Dichotomous Data

Problem; Chapter 3, The One-Sample Location Problem; Chapter 4, The Two-Sample Location Problem; Chapter 5, The Two-Sample Dispersion Problem; Chapter 6, The One-Way Layout; Chapter 7, The Two-Way Layout; Chapter 8, The Independence Problem; Chapter 9, Regression Problems Involving Slopes; Chapter 10, Tests Designed to Detect Broad Alternatives. The format of presentation is nonmathematical. A knowledge of calculus is not required to understand the development. However, some degree of mathematical sophistication is necessary to be familiar with the statement of the models and assumptions.

The authors have purposely narrowed the number of procedures discussed. In each section, they have chosen one procedure to apply to a standard statistical problem. For example, the WILCOXSON rank sum test is discussed under two sample tests of location alternatives. This approach is complemented by extensive use of examples from such sixteen diverse fields as medicine, home economics, and geology. The examples are extracted from the literature and are referenced for more complete study. With the use of these examples, the application of the selected procedure is skillfully and lucidly presented. Problems at the end of each section are referenced to an example or to comments within the section for added amplification. The last problem in each section is a vocabulary check.

The text contains 10 chapters (254 pages) with a complete set of tables (180 pages) referenced to the procedures in the text. A glossary (33 pages) with definitions of the terms and symbols is included to aid the reader who encounters unfamiliar concepts or terms. A complete bibliography (25 pages) of examples from the literature and alternative statistical procedures is also included. An author index (7 pages) and a subject index (7 pages) are provided.

Each section is divided into the following subsections:

Procedure: A step-by-step description of how to apply the procedure under discussion is given. *Large Sample Approximation:* Applicable approximations are provided. *Ties:* Adjustments to the procedure in case of tie scores are presented. *Examples:* Examples are chosen from scientific literature to illustrate the procedure. *Comments:* Underlying assumptions, intuitive motivation, related methods, computational hints, and special references are succinctly discussed. *References:* Alternative procedures are cited in the bibliography. *Problems:* Examples and amplifications of the Comments Section are for further study.

As a ready reference text, this book can be used by practicing scientists and consulting statisticians. The text is self-contained in that the procedures are accompanied by extensive numerical tables and bibliographical references. The excellent examples within each section can be used as patterns for application to similar problems.

Finally, this book can be used as the primary text for a course in applied nonparametric statistics. Reference to alternative procedures can be made a part of the out-of-class research projects. However, additional problems and topics will be needed to supplement the text.

This text is another excellent addition to the Wiley Series in Probability and Mathematical Statistics. It is well done with few typographical errors. The teaching experience of the authors in the field of Applied Nonparametric statistics during the seven years' development of this text is reflected in the quality of presentation. Although written in a concise manner, the text will be found interesting to the reader.

The authors have achieved their goal of making "Current and future scientist

... aware of nonparametric methods..." This text will be used extensively by the student and the practicing scientist who wants to study and apply nonparametric procedures.

WILLIAM FULKERSON
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- LUDWIG ARNOLD, *Stochastic Differential Equations—Theory and Applications*, John Wiley & Sons, New York, N.Y., 1974, 228 pages, \$17.95.
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