



Operations Research

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

The Analyst's Bookshelf

To cite this article:

(1963) The Analyst's Bookshelf. Operations Research 11(4):661-667. <https://doi.org/10.1287/opre.11.4.661>

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The Analyst's Bookshelf

Joseph F. McCloskey, Editor

THIS is the last issue of The Analyst's Bookshelf that will be edited by DR JOSEPH MCCLOSKEY. Because of the pressures of other duties he has asked to be relieved of this position. Since he has done a fine job for so long we dislike losing him but it is no more than fair to him to accept his resignation. Joe has taken *The Analyst's Bookshelf* from just a rough idea through the growing stages to a thriving section of the JOURNAL. Its book reviews give us insight into the various new publications available and his personal comments have been informative and delightful to read. It is with deep regret that his resignation is accepted and we hope that *The Analyst's Bookshelf* in the future will be as stimulating as it has been in the past under his editorship.

GEORGE SHORTLEY, *Past Editor*, } OPERATIONS
THOMAS CAYWOOD, *Editor*, } RESEARCH

BOOKS

Reviews

BURTON V. DEAN, MAURICE W. SASIENI, and SHIV K. GUPTA,
Mathematics for Modern Management, John Wiley & Sons,
Inc., New York, N. Y., 1963, 442 pages, \$8.50

THE authors' stated purpose in writing this book was to create a mathematics text specifically for business and economic students and a reference book for the practicing manager. They intend the book to be used by undergraduate and graduate students and assume only a knowledge of college algebra and trigonometry.

The text is divided into five sections, with the first devoted to "Fundamental Concepts." Sets and Relations, Functional Representation, Series, Limits, and Continuity, and Coordinate Geometry. Although many of the concepts brought forward in this section are very elementary, others are advanced undergraduate level.

The second section of the book deals with "Deterministic Systems." The Derivative of a Function, The Problem of Optimization, Taylor's Theorem and Some Applications, and Deterministic Models. The first three chapters of this section introduce the student to finite differences, differential calculus, partial differentials, Lagrange multipliers, binomial theorem, etc. The final chapter of the section illustrates, using management-oriented problems, the material previously discussed. The third section covers the subjects of Integration, Differential Equations, and Probability Theory and Stochastic Models. The next section, "Linear Systems,"

is devoted entirely to linear programming except for a short introduction to matrix notation and operations. The final section, "The Mathematics of Finance," includes chapters titled Interest, Annuities, and Investments, and Actuarial Tables, Personnel, Financial, and Equipment Problems Involving Probability.

Where possible, the text material is developed or illustrated through the use of business-oriented examples and each chapter is concluded by a list of pertinent exercises.

It is the reviewer's opinion that, because of the great variety of topics covered in such condensed form, the book is excellent as a review course and as a basic reference book, but is not well suited as an undergraduate text.

RICHARD P. ROHRBACH
North American Aviation, Inc.

**L. R. FORD, JR., and D. R. FULKERSON, *Flows in Networks*,
Princeton University Press, Princeton, N. J., 1962,
194 pages, \$6.00**

THIS book presents an approach to a part of linear-programming theory generally known as network-flow problems or flows in linear graphs. It is devoted mainly to special kinds of linear programs that arise in transportation, communication, or combinatorial problems and to presenting special algorithms for solving these linear problems. In general, purely linear-flow problems are treated and, in particular, those for which the assumption of integral data in the problem implies the existence of an integral solution, special algorithms being furnished for computing answers.

The mathematical problem involved here—that of determining a maximal flow from one point to another in a network—arises naturally in the problem areas mentioned above. It is one of extremizing a linear function subject to restraints in the form of linear equations and linear inequalities.

In the earlier part of the book the emphasis is on directed finite networks but eventually undirected and mixed networks are considered. The networks involved are generally capacity-constrained but it is found to be useful in network extensions and for particular types of problems and procedures to allow infinite capacity. A mathematical theory of network flows is presented, along with techniques for adapting certain general problem types to the theory. This is implemented with computational schemes for solving particular problem types. The simplex method of solution for network flow problems is not discussed, a reason suggested by the authors is that the procedure they follow results in computationally better schemes.

Set-theoretic notions and notations are used throughout the text. As the authors have indicated, this is essentially a book on applied mathematics, but a number of topics purely mathematically motivated have been included.

Chapter I formulates the concept of a static (i.e., nontime-dependent) flow through a network, along with additional concepts needed to prove the fundamental theorem concerning maximal network flow. Inherent in the proof is the so-called 'labeling process' for computationally solving maximum-flow problems. A basic theorem showing the applicability of network-flow theory to particular types of combinatorial problems is also given.

Chapter II is devoted to determining network flows satisfying additional linear restraints. Feasibility theorems are given for supply-demand type problems as well as for flows that are source- and sink-free. Combinatorial problems discussed include bottleneck assignment and minimum number of individuals to meet a fixed schedule of tasks. The notion and usage of partially ordered sets are introduced, along with necessary and sufficient conditions for the existence of systems of distinct and restricted representatives, the latter two being in the general category of set representatives. An interesting sidelight in this chapter is a rather comprehensive discussion of 0,1 matrices (with restraints) that arise in certain combinatorial problems and in particular how some of them may be handled via flow theory.

Chapter III utilizes results of the first two chapters to construct networks that, in general, minimize cost. The Hitchcock problem with solution algorithms, optimal-assignment problems, warehousing-type problems, and caterer problems are treated from the flow standpoint. The concept of dynamic flow is introduced and handled, and project cost curves are also discussed from the flow-theory standpoint.

Chapter IV is in the same general spirit as Chapter I except that more topological concepts are introduced and multiterminal maximal flows are discussed.

In general, the presentation is complete and forthright with adequate examples furnished to illustrate new concepts and to demonstrate the computational procedures evolved. Brief historical sketches are given and on occasion motivation is formally provided for proceeding in a particular manner. Occasional statements about unsolved problems and what is not known in pertinent areas are also to be found.

The reference lists are generous and due credit is given to particular authors whose expositions are somewhat parallel or who contributed to the general theory. Chapter and section head designations, along with an adequate index, make for rather easy location and cross reference. Few typographical errors were noted.

The authors' goal in placing emphasis on constructive procedures and proofs leading to efficient computational schemes wherever possible has been met.

This is a highly technical book that the somewhat mathematically unsophisticated reader may find 'rough going' in spots. However, for those willing to devote the necessary time to understanding, rather than to learning methodology, it is recommended without reservation.

ROBERT S. DEZUR
Martin/Denver

Books Received (to be reviewed)

JAMES H. BATCHELOR, *Operations Research, An Annotated Bibliography*, Vol. 3, St. Louis University Press, St. Louis, Mo., 1963, 384 pages, \$12.50.

ROBERT GOODELL BROWN, *Smoothing, Forecasting and Prediction of Discrete Time Series*, Prentice-Hall, Inc., Englewood Cliffs, N. J., 1963, 468 pages, \$13.25.

DONALD J. CLOUGH, *Concepts in Management Science*, Prentice-Hall, Inc., Englewood Cliffs, N. J., 1963, 425 pages, \$12.00.

JOHN F. MEE, *Management Thought in a Dynamic Economy*, New York University Press, New York, N. Y., 1963, 138 pages, \$3.00.

- DON G MITCHELL, *The Challenges Facing Management*, New York University Press, New York, N Y , 1963, 70 pages, \$2 50
- WILLIAM T MORRIS, *Management Science in Action*, Richard D Irwin, Inc, Homewood, Ill , 1963, 308 pages, \$9 00

Other Books Received

- BERNARD BAUMRIN, ed , *Philosophy of Science*, The Delaware Seminar, Volume I, 1961-1962, Interscience Publishers, New York, N Y , 1963, 370 pages, \$9 75
- EDWIN F BECKENBACH, ed , *Modern Mathematics for the Engineer*, McGraw-Hill Book Company, New York, N Y , 1963, 514 pages, \$3 45 (paper)
- RUEL V CHURCHILL, *Fourier Series and Boundary Value Problems*, 2nd edition, McGraw-Hill Book Company, Inc , New York, N Y , 1963, 248 pages, \$6 75
- JOHN G HERRIOT, *Methods of Mathematical Analysis and Computation*, John Wiley & Sons, Inc , New York, N Y , 1963, 198 pages, \$7 95 A reference, primarily for the aircraft engineer
- HENRY G HODGES AND RAYMOND J ZIEGLER, *Managing the Industrial Concern*, Houghton Mifflin Company, Boston, Mass , 1963, 735 pages, \$8 00 Under graduate text
- JOHN F HOGERTON, *The Atomic Energy Deskbook*, Reinhold Publishing Corporation, New York, N Y , 1963, 673 pages, \$11 00 A handy "dictionary-encyclopedia of atomic energy principles and applications " There are more than 1,000 entries, ranging from definitions to articles There are, in addition, a bibliography and a listing of libraries from which AEC literature is available
- ISAAC M HOROWITZ, *Synthesis of Feedback Systems*, Academic Press, Inc , New York, N Y , 1963, 726 pages, \$16 50
- Jet Propulsion Laboratory, California Institute of Technology, *Mariner Mission to Venus*, McGraw-Hill Book Company, Inc , New York, N Y , 1963, 118 pages, \$3 50 (paper \$1 45)
- ERIC L KOHLER, *A Dictionary for Accountants*, 3rd edition, Prentice-Hall, Inc , Englewood Cliffs, N J , 1963, 523 pages, \$14 95
- D K C MACDONALD, *Introductory Statistical Mechanics for Physicists*, John Wiley & Sons, Inc , New York, N Y , 1963, 176 pages, \$6 75
- ALAN S MANNE AND HARRY M MARKOWITZ, eds , *Studies in Process Analysis Economy-wide Production Capabilities*, Cowles Foundation Monograph 18, Proceedings of a Conference Sponsored by The Cowles Foundation for Research in Economics at Yale University, April 24-26, 1961, John Wiley & Sons, Inc , New York, N Y , 1963, 427 pages, \$14 00
- J MILNOR, *Morse Theory*, based on lecture notes by M SPIVAK AND R WELLS, Annals of Mathematics Studies No 51, Princeton University Press, Princeton, N J , 1963, 153 pages, \$3 00
- ALEXANDER M MOOD AND FRANKLIN A GRAYBILL, *Introduction to the Theory of Statistics*, 2nd edition, McGraw-Hill Book Company, Inc , New York, N Y , 1963, 443 pages, \$8 95 A thorough-going revision of an established introductory text
- JAMES R MUNKRES, *Elementary Differential Topology*, Annals of Mathematics

Studies No 54, Princeton University Press, Princeton, N J , 1963, 107 pages, \$2 75

IVAN NIVEN, *Diophantine Approximations*, Interscience Publishers, New York, N Y , 1963, 68 pages, \$5 00

PHILIP M. SHERMAN, *Programming and Coding Digital Computers*, John Wiley & Sons, Inc , New York, N Y , 1963, 444 pages, \$11 00

MARK E. STERN, *Mathematics for Management*, Prentice-Hall, Inc , Englewood Cliffs, N J , 1963, 454 pages, \$11 65 A textbook that includes chapters on elements of algebra and analytic geometry, functions of one variable, differential calculus, differential calculus with functions of several variables, integral calculus, differential equations, difference equations, vectors and matrices, linear programming, and the concept of utility and the theory of games It is designed as a first-year graduate text in an MBA program, and therefore each chapter is introduced and closed by a business problem involving the mathematics of the chapter The jacket description is in a quite different vein " this book takes its place on the mandatory reading lists of every individual involved in management "

ALAN STUART, *Basic Ideas of Scientific Sampling*, Hafner Publishing Company, New York, N Y , 1962, 99 pages, \$3 50

Systems and Procedures Association, *Ideas for Management* (papers and case histories presented at the 1962 International Systems Meeting), Systems and Procedures Association, 7890 Brookside Drive, Cleveland 38, Ohio, 1963, 452 pages, \$10 00

PETER WEGNER, *An Introduction to Symbolic Programming*, Hafner Publishing Company, New York, N Y , 1962, 219 pages, \$6 45

PERIODICALS

Selected Contents

Operational Research Quarterly, March 1963

The Operational Research Society Annual Conference, October 1962

Papers Relating to Planning

PATRICK RIVETT, Opening Address

J R LAWRENCE AND A D J FLOWERDEW, "Economic Models for Production Planning"

W YOUNG, J G FERGUSON, AND B CORBISHLEY, "Some Aspects of Planning in Coal Mining"

JACQUES LESOURNE, "Operational Research in the Service of National Planning"

RICHARD STONE, "Models of the National Economy for Planning Purposes"

ROGER EDDISON, Closing Address

PETER T MCINTOSH, "Initial Solutions to Sets of Related Transportation Problems"

D J BARTHOLOMEW, "Two-Stage Replacement Strategies"

Management Science, April 1963

- C WEST CHURCHMAN, "The X of X"
 D W JORGENSEN AND J J McCALL, "Optimal Replacement Policies for a Ballistic Missile"
 H THEIL, "On the Symmetry Approach to the Committee Decision Problem"
 WILLIAM PRAGER, "A Structural Method of Computing Project Cost Polygons"
 C VAN DE PANNE AND W POPP, "Minimum-Cost Cattle Feed under Probabilistic Protein Constraints"
 HERBERT TERRY, "Comparative Evaluation of Performance Using Multiple Criteria"
 FREDERICK S HILLIER, "The Derivation of Probabilistic Information for the Evaluation of Risky Investments"
 NORMAN DALKEY AND OLAF HELMER, "An Experimental Application of the Delphi Method to the Use of Experts"
 WILLIAM M EVAN, "Indices of the Hierarchical Structure of Industrial Organizations"
 CYRUS DERMAN, "Optimal Replacement and Maintenance under Markovian Deterioration with Probability Bounds on Failure"
 ELIEZER NADDOR, "On the Equivalence of Some Inventory Systems"
 MURRAY A GEISLER, "A Study of Inventory Theory"

Naval Research Logistics Quarterly, September–December 1962

- G G ALWAY, "A Triangularization Method for Computations in Linear Programming"
 A CHARNES AND W W COOPER, "Programming with Linear Fractional Functionals"
 I RICHARD SAVAGE, "Surveillance Problems"
 PAUL BROCK, WALTER D CORRELL, AND GEORGE W EVANS, II, "Techniques for Evaluating Military Organizations and Their Equipment"
 R S LEDLEY AND L S ROTOLO, "A Heuristic Concept and an Automatic Computer Program Aid for Operational Simulation"
 H C JAIN, "Queuing Problem with Limited Waiting Space"
 MINORU SAKAGUCHI, "Pure Strategy Solutions to Blotto Games in Closed Auction Bidding"
 W R ALLEN, "Simple Inventory Models with Bunched Inputs"
 C MOHAN AND K L ARORA, "Analytical Study of a Problem in Air Defense"
 K L ARORA, "A Generalized Problem in Air Defense"

Journal of Industrial Engineering, May–June 1963

- A ALAN B PRITSKER, "The Monte Carlo Approach to Setting Maintenance Tolerance Limits"
 NORMAN N BARISH AND NORBERT HAUSER, "Economic Design for Control Decisions"

Selected Articles

Business Week for April 20, 1963, has a one-page feature on Frederick W Taylor and the beginnings of 'Scientific Management' It also has an article on the use of marginal-cost techniques by Continental Air Lines

J W JOHNSON, C J HUDSON, AND G A COOPER report on "An Experiment in Operational Planning" in the April 1963 issue of *The Engineering Journal*. The experiment involved the interregional movement of freight cars in the Canadian National Railways, with the objective of reducing empty-car days by anticipating requirements and surpluses.

It is to be hoped that HARVEY M WAGNER's "Practical Slants on Operations Research" evokes a wave of similar efforts to discuss operations research for management in management terms rather than in operations-research terms. It appears in the May-June 1963 issue of *Harvard Business Review*.

Dunod, Paris, announces publication, beginning with the first quarter of 1963, of *Revue Française de Traitement de l'Information* for the French Association for Computing and Information Processing. Subscription price is 49 francs per year.

The Mental Health Research Institute of the University of Michigan has available a limited number of copies of an address by MERRILL M FLOOD, under the title, "What Future is There for Intelligent Machines?" The speech will be published as an article in the next edition of the *Yearbook* of the Society for General Systems Research. Requests for copies should be addressed to the author.

EFFECTIVE with the next issue of OPERATIONS RESEARCH, DR HUGH MISER becomes Editor of *The Analyst's Bookshelf*. I would like to thank all those who have contributed reviews and comments to the Bookshelf over the past four and one-half years. And I want to thank those who made suggestions of ways of increasing the value of the Bookshelf to the readers of the JOURNAL.

JOSEPH F McCLOSKEY