



Operations Research

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

The Analysts' Bookshelf

To cite this article:

(1957) The Analysts' Bookshelf. Operations Research 5(4):603-608. <https://doi.org/10.1287/opre.5.4.603>

Full terms and conditions of use: <https://pubsonline.informs.org/Publications/Librarians-Portal/PubsOnLine-Terms-and-Conditions>

This article may be used only for the purposes of research, teaching, and/or private study. Commercial use or systematic downloading (by robots or other automatic processes) is prohibited without explicit Publisher approval, unless otherwise noted. For more information, contact permissions@informs.org.

The Publisher does not warrant or guarantee the article's accuracy, completeness, merchantability, fitness for a particular purpose, or non-infringement. Descriptions of, or references to, products or publications, or inclusion of an advertisement in this article, neither constitutes nor implies a guarantee, endorsement, or support of claims made of that product, publication, or service.

© 1957 INFORMS

Please scroll down for article—it is on subsequent pages



With 12,500 members from nearly 90 countries, INFORMS is the largest international association of operations research (O.R.) and analytics professionals and students. INFORMS provides unique networking and learning opportunities for individual professionals, and organizations of all types and sizes, to better understand and use O.R. and analytics tools and methods to transform strategic visions and achieve better outcomes. For more information on INFORMS, its publications, membership, or meetings visit <http://www.informs.org>

The Analysts' Bookshelf

**M. G. BEKKER, *Theory of Land Locomotion—The Mechanics of Vehicle Mobility*, University of Michigan Press, Ann Arbor, Michigan, 1956,
538 pp. \$12.50**

IN ITS FIELD, this book can only be described as *monumental*. In fact, representing as it does the culmination of a life's work, it is indeed a monument to the creative and investigative ability of a first-class scientist. It is must reading for those interested in any aspect of land transportation. It is recommended reading for any individual interested in or engaged in research and analysis, including operations analysis, as an example of superb and fundamental research.

For those interested in the details, a portion of the publisher's description follows. "Here is a comprehensive source of the information now available on the relations between a motor vehicle and the physical environment in which it operates. It lays the foundation for a new type of applied mechanics by systematizing the accumulated experience of men who have worked closely with automotive problems over the past forty years—engineers, designers, technicians, and production men. The result is an integrated theory of land locomotion which will advance land transportation much as aerodynamics and hydrodynamics have helped the development of air and sea travel. Placing particular emphasis on off-the-road vehicles, the book discusses in detail problems of soil and snow mechanics; size-form relationships as an index of economy; terrain conditions; the process of moving tracks, skis, sleds, toboggans, rigid wheels, and pneumatic tires; static and dynamic behavior, dimensional analysis, testing, and over-all economy."

The author sets the stage with a fascinating introduction of nature's solutions to the problem; reviews the efforts of man to accommodate himself to the problems of movement from earliest times; reviews in detail the impact of modern technological advances on transportation techniques; and, finally, shows throughout that although modern technology now permits radically new solutions, basic research has not kept up with the potential. Of special interest is the fact that the author never neglects to make an attempt to quantify every aspect of the problem carefully, be it the flow of a river, the movement of a biped, or the most advanced cross-country heavily armored vehicle.

Lest the prospective reader be concerned that the book is merely an academic exercise, it should be explained that the author has successfully put his theories into practice, and gives numerous examples of test of these theories in practical applications. Only recently one of the author's developments has produced a vehicle that glides on the surface of snow when a man would sink to his hips were he to descend from the vehicle. Further, the design of this vehicle is such that new encouragement has been given to the practicability of employing nuclear propulsion in land vehicles.

J. W. JOHNSON
Operations Research Office

O. O. RESNIKOFF and R. W. LIEBERMAN, *Tables of the Non-Central t -Distribution*, Stanford University Press, Stanford, California, 1957, 389 pp., \$12.50

THE PRINCIPAL application of these tables is in the construction of sampling schemes for the fraction of normally distributed random variables falling above or below specified values. Several examples of possible applications are given in the 29 pages of introductory material, which concludes with a short bibliography. The work was undertaken to facilitate the construction of variables sampling plans in industrial acceptance sampling under sponsorship of the Office of Naval Research. The contents of the volume are best described by a quotation from the introductory discussion:

Three tables of the non-central t -statistic are given: the probability integral, the probability density function, and the percentage points of t .

Tabulation of the non-central t -distribution requires a table of triple entry since the distribution depends on the two parameters f and δ , where f is the number of degrees of freedom and δ is the non-centrality parameter.

The argument used throughout the tables is $x = t/\sqrt{f}$. The reason for using $t/\sqrt{f}$ as the argument instead of t itself is that the range for this argument is roughly the same whatever the values of the parameters f and δ . This enables a somewhat more compact form of tabulation than would be possible if the argument were t itself.

The ranges of the parameters f and δ are as follows: f ranges from 2 to 24 by steps of 1 and from 24 to 49 by steps of 5; and $\delta = \sqrt{f+1} k_p$, where k_p is the standardized normal random variable exceeded with probability p ; that is,

$$\frac{1}{\sqrt{2\pi}} \int_{k_p}^{\infty} e^{-y^2/2} dy = p.$$

The values of p which were used are $p = 0.2500, 0.1500, 0.1000, 0.0650, 0.0400, 0.0250, 0.1000, 0.0040, 0.0025$, and 0.0010 . A table of $\sqrt{f+1} k_p$ for these values of f and p is given.

These values of the parameters were chosen so as to cover the useful range adequately. In particular, the choice of $f=2(1)24$ and $24(5)49$ appears to fill the needs for most practical applications. It is felt that for f greater than 49, a normal approximation is adequate. The values for f of $24(5)49$ were chosen rather than f of $25(5)50$ because most practical applications require that $f = n - 1$ where n is the sample size. Sample sizes which are multiples of 5 are prevalent in industrial statistics.

WILLIAM F. WHITMORE
Bureau of Ordnance, U.S. Navy

EDWARD H. BOWMAN and ROBERT B. FETTER, *Analysis for Production Management*, Richard D. Irwin, Inc., Homewood, Illinois, 1957, 503 pp., \$7.80

THIS BOOK was designed for use as a text in the initial production-management course offered to juniors and first-year graduate students at M.I.T.'s School

of Industrial Management. It differs from older texts on production management in that a description of the many functions and systems to be found in industrial production is not given. Instead a description is given of some analytical concepts and techniques that have been found useful in considering production-management problems.

The prerequisites for an intelligent reading of this text are an elementary knowledge of calculus, probability theory, and economics. The reader equipped with only this elementary knowledge will find the section on statistical analysis abstruse.

In the first two chapters, the major types of manufacturing problems are set forth, and terms such as *suboptimization* and *model* are discussed. Then follows a chapter on schematic models—flow process charts, Gantt charts, etc.—which have been found useful in the analysis of production-management problems.

In Section II the linear-programming model is introduced. Using pictures, examples, and a minimum of mathematics, this model and the simplex method of solution are explained. Dynamic programming is described briefly.

Section III, Statistical Analysis, covers in less than one hundred pages statistical quality-control charts, attributes and variables sampling plans, and simple analysis of variance models.

In Section IV a six-step procedure for analyzing an economic problem is presented. The well-known economic-lot-size model is used as an example in this exposition. Three special cases of this general approach are presented in the following chapters on incremental analysis, Monte Carlo analysis, and equipment-replacement analysis.

There are problems and references at the end of each chapter and ten cases near the end of the book. Each of these cases is as accurate a picture of a production operation as could be given, stripped from its industrial setting. Tables of the normal, t , R/σ' , and F distributions plus tables of random numbers, e^{-x} , and waiting time and machine availability for selected servicing constants are presented in Appendices.

The book will aid in bridging the gap between the analytical techniques that have recently proven practical and the needs and capabilities of the industrial manager.

JOHN E. GESSFORD
Stanford University

MATRIX ALGEBRA, ACCOUNTING, AND PRODUCTION PLANNING

THE Viennese Institute of Technology publishes a journal entitled *MTW-Mitteilungen*, MTW standing for Mathematics, Technology, Economy. Issues No. 3 and 4 of 1956 have a sequence of two articles by O. PICHLER, Leuna, Germany, dealing with an application of matrix algebra to accounting and production problems that deserve review.

Suppose that during an accounting interval a plant is producing r different finished products. Let the components of the r -dimensional 'output vector' $\mathbf{f}$ represent the produced quantities. Similarly, we introduce the r -dimensional vector $\mathbf{s}$ for the yet unknown unit costs of the finished products, the t -dimensional vector $\mathbf{a}$ for the input, and the t -dimensional vector $\mathbf{p}$ for the known unit costs of the t input

categories (raw materials, services, etc.). All vectors apart from s are assumed known. Corresponding to the number n of departments the input and output vectors are split as follows: $f = \sum_{i=1}^{i=n} f_i$; $a = \sum_{i=1}^{i=n} a_i$; thus giving birth to two matrices F and A . The fundamental 'accounting equations' are given by $sF + pA = 0$. This system of linear equations cannot always be solved uniquely (by a matrix inversion) but it can considerably simplify the accounting process owing to its introduction of consistency requirements. The approach will be useful only for plants with a complex flow of materials and services.

The author also gives a description of the plant structure and technology by a set of matrices from which (by several matrix inversions) he derives linear relations between the input and output vectors. These relations can be used for production planning, production control, and an analysis of deviation of costs from planned costs.

FRED HANSSMANN

Case Institute of Technology

LECTURES ON OPERATIONS RESEARCH AT THE UNIVERSITY OF MADRID

A VOLUME of approximately 130 pages, *Conferencias de Investigación Operativa*, has been received from the School of Statistics of the University of Madrid. This volume contains the following lectures given at the School of Statistics in April 1954 (in Spanish):

SIXTO RIOS—*Methods and Problems of Operations Research*

RICARDO SAN JUAN—*The Simplex Method in Linear Programming*

JOSÉ CASTAÑEDA—*Linear Programming and Economic Theory*

JUAN BÉJAR—*A Study of the Problem of the Transportation of Minerals*

GONZALO ARNÁIZ—*Inspection by Sampling*

FRANCISCO AZORIN POCH—*A Factorial Design Applied to the Study of Productivity*

ENRIQUE BLANCO—*Operational Concepts in Inspection*

JOSÉ ROMANI—*Queuing Theory Applied to a Production Problem*

PROCOPIO ZOROA—*Operational Analysis in Advertising*

STANFORD RESEARCH INSTITUTE JOURNAL

THE Stanford Research Institute has initiated publication of a new quarterly Journal addressed primarily to readers in business, industry, education, and government. This Journal will contain discussions on the contributions of research to problems of general interest to this audience. The subscription rate is \$4.00 per year. The first issue, of 32 pages in large format, contains the following articles:

EGER V. MURPHREE—*Guided Missiles and Research*

NEIL H. JACOBY—*The Economic Prospect for The United States Panel Discussions, Associates Day Conference*

KENNETH ELDREDGE, FRED KAMPHOFNER, AND PAUL WENDT—*Teaching Machines to Read*

DAN McLACHLAN, JR.—*Photography of Atoms*

TELETEKNIK

TELETEKNIK, reviewed here, is the first English edition—vol. I, No. 1, 1957—of a journal by the same name published by the Post and Telegraph Office and the Concessionary Telephone Companies in Denmark. The journal has been in existence for many years. A desire on the part of English-speaking workers and investigators in the fields of communication theory and congestion theory (frequently known as queuing theory) for useful research material appearing in the journal, has brought about the English version. The editors have decided to publish one or two numbers of the English editions annually, containing papers of general interest to readers outside Denmark.

In this first issue, there are 26 good summaries and papers delivered at The First International Congress on the Application of the Theory of Probability in Telephone Engineering and Administration. It contains papers by each of the well-known editors of Erlang's works, E. BROCKMEYER and A. JENSEN. The latter's paper studies applications of decision theory to planning and operation in a telephone plant.

Several of the papers extend or refer to the well-known works of A. K. Erlang in queuing theory. In his paper, *The Beginning of Switching Theory in the United States*, R. I. WILKINSON reviews the rapid growth of telephony in this country, and both engineering and mathematical methods developed to deal with traffic fluctuations. Of particular interest is his summary of the work done by Molina, who used Poisson approximation to the binomial to obtain the steady-state waiting time in the constant-holding-time, multiple-channel queue (See *Résumé of Queuing Theory*, by the reviewer, this JOURNAL, April 1957). Another paper, by L. KOSTEN, reviews the development of applications of probability theory to traffic engineering problems in Europe. He points out some differences between the stochastic theoretic approach and the combinatorial approach to queuing problems by the Lubberger School. From the standpoint of applications, there are objections to both; however, they are more serious toward the latter whose results are of little value for prediction purposes despite an attempt at averaging results. This paper is followed by one by R. FORTET AND B. CANCELL which studies the loss of call probabilities in a telephone system with a central bureau available to several long distance call points. The calls demanding a certain direction are Poisson distributed.

An interesting paper *On the Special Use of the Erlang Methods In Industry*, by E. R. BUCH, gives some of Palm's applications of Erlang's methods to the optimal assignment of men, each to operate several machines. Another valuable paper, although only given as a descriptive summary here, is by R. SYSKI, who relates with rigorous mathematics *Analogies Between the Congestion and Communication Theories*. By stochastic-process methods, the author specializes his results to a comparison of Shannon's and Wiener's works (discrete case) and time-homogeneous Markov chains. It is shown that the discontinuous congestion process in a group of devices can be regarded as an information source, thus forming the analogue of the first link in the communication system, and the particular realization of this process is the message produced by that source. Similarities between the two theories are indicated, etc.

The reviewer's opinion is that the translation is a worthwhile effort, and from the few titles mentioned it is clear that the journal shares interests with those of OPERATIONS RESEARCH in this country, particularly in communications and congestion theories. It is a welcome addition to the literature.

THOMAS L. SAATY
Operations Evaluation Group

BOOKS RECEIVED

- Automatic Coding*, Proceedings of the Symposium Held January 24-25, 1957 at The Franklin Institute, Journal of The Franklin Institute, Philadelphia, Pennsylvania, 1957, 118 pp., \$3.00.
- EDWARD N. BALDWIN AND BENJAMIN W. NIEBEL, *Designing for Production*, Richard D. Irwin, Inc., Homewood, Illinois, 1957, 645 pp., \$8.40.
- GEORGE E. CONDOYANNIS, *Scientific German—A Concise Description of the Structural Elements of Scientific and Technical German*, John Wiley & Sons, Inc., New York, 1957, 164 pp., \$2.50.
- ADRIANUS J. DEKKER, *Solid State Physics*, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1957, 540 pp., \$9.00.
- JOHN G. KEMENY, J. LAURIE SNELL AND GERALD L. THOMPSON, *Introduction to Finite Mathematics*, Prentice-Hall, Inc., New York, 1957, 372 pp., \$6.65.
- FRED E. KINDIG, *Fundamentals of Linear Programming and Workshop Manual*, Bureau of Business Research, University of Pittsburgh, Pittsburgh, Pennsylvania, 1956, \$5.00.
- FRED E. KINDIG, *Fundamentals of Statistical Controls and Workshop Manual*, Bureau of Business Research, University of Pittsburgh, Pittsburgh, Pennsylvania, 1956, \$5.00.
- D. D. McCracken, *Digital Computer Programming*, John Wiley & Sons, Inc., New York, 1957, 253 pp., \$7.75.
- JOHN S. RICHARDSON, *Science Teaching in Secondary Schools*, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1957, 385 pp., \$6.00.
- ROBERT M. THRALL AND LEONARD TORNHEIM, *Vector Spaces and Matrices*, John Wiley & Sons, Inc., New York, 1957, 318 pp., \$6.75.
- ABRAHAM WALD, *Selected Papers in Statistics and Probability*, Stanford University Press, Stanford, California, 1957, 702 pp., \$10.00.