REVIEWS AND DESCRIPTIONS OF TABLES AND BOOKS

1[C, K, L]. GERALD J. LIEBERMAN & DONALD B. OWEN, *Tables of the Hypergeometric Probability Distribution*, Stanford University Press, California, 1961, 7 + 726 p., 24 cm. Price $15.00.

In this volume there are three main tables of the hypergeometric probability distribution and a table of logarithms of factorials. The nomenclature of sampling inspection is used to describe the parameters of the hypergeometric probability distribution. The main tables give the values of $p(x) = p(N, n, k, x)$ and $P(x) = P(N, n, k, x)$, where

N = number of items in a lot,
n = number of items in a sample taken from the lot,
k = number of defective items in the lot,
x = number of defective items observed in the sample.

Then, the probability

$$p(x) = \Pr\{\text{Exactly } x \text{ defectives are found in sample}\}$$

$$= \frac{k!\,n!}{(k-x)!\,(n-x)!\,x!} \cdot \frac{(N-k)!\,(N-n)!}{N!(N-k-n+x)!},$$

x being an integer such that $[0, n + k - N] \leqq x \leqq \min\,[n, k]$, and $P(x) = Pr\ \{x$ defectives or fewer are found in sample$\}$

$$= \sum_{i=M}^{x} \frac{k!\,n!}{(k-i)!\,(n-i)!\,i!} \cdot \frac{(N-k)!\,(N-n)!}{N!(N-k-n+i)!},$$

where $M = \max\,[0, n + k - N]$.

The first table lists the values of $p(x)$ and $P(x)$ to six decimal places for $N = 2(1)49$, $50(10)100$, $n = 1(1)\ N - 1$, $k = 1(1)\ n$, $x = 0(1)\ k$, for $N \leqq 25$. For $N > 25$, the values of $p(x)$ and $P(x)$ are given only up to

$$n = \frac{N}{2} \quad \text{or} \quad n = \frac{N-1}{2},$$

N even or odd, respectively. The authors note that by the use of certain symmetry relationships, all possible $p(x)$ and $P(x)$ can be obtained.

The second table gives the values of $p(x)$ and $P(x)$ to six decimal places for $N = 1000$, $n = 500$, $k = 1(1)\ 500$, $x = 0(1)\ k/2$ (k even), $(k - 1)/2$ (k odd). Entries are omitted when $p(x) < 10^{-6}$.

The third table gives the values of $p(x)$ and $P(x)$ to six decimal places for $N = 100(100)\ 2000$, $n = \frac{1}{2}N$, $k = n - 1, n$, and $x = 0(1)\ n/2$ (n even), $(n - 1)/2$ (n odd). Entries are omitted when $p(x) < 10^{-6}$.

The fourth table is a list of $\log N!$ for $N = 1(1)\ 2000$ taken from *Logarithms of Factorials from 1 to 2000*, by D. B. Owen and C. M. Williams, Sandia Corporation Monograph SCR-158, December 1959. Values of $\log N!$ in this table are given to fifteen decimal places, and were used for the calculation of $p(x)$ and $P(x)$. The values of $p(x)$ and $P(x)$ in all tables are claimed to have been computed correct to at least eight decimal places before they were rounded to six decimal places.

The introductory part of this volume includes the definitions of the hypergeometric function and the various symmetry relationships, applications, approximations and interpolations, a summary of some useful formulas on sums of combinatorials, and a bibliography of 66 references. Examples given in applications include sequential procedure, test of the equality of two proportions, distribution of the number of exceedances, Bayesian prediction, and sampling inspection.

The reviewer's immediate reaction to these tables is that the type face is too small for easy reading and that the format makes it difficult to find the values of the indexing parameters. However, considering the 135,874 entries and the 726 pages, it would be difficult to eliminate these faults without prohibitive increase in both the size and cost of this volume.

H. H. Ku

National Bureau of Standards
Washington, D. C.

2[G, I, X, Z]. Ralph G. Stanton, *Numerical Methods for Science and Engineering*, Prentice-Hall, Inc., Englewood Cliffs, N. J., 1961, xii + 266 p., 23 cm. Price $9.00.

This book is designed as a textbook for an introductory course in numerical methods for students in the physical sciences and engineering with a good knowledge of calculus and differential equations. The selection of topics is fairly standard, as one would gather from the following chapter headings: Ordinary Finite Differences, Divided Differences, Central Differences, Inverse Interpolation and the Solution of Equations, Computation with Series and Integrals, Numerical Solution of Differential Equations, Linear Systems and Matrices, Solution of Linear Equations, Difference Equations, Solution of Differential Equations by Difference Equation Methods, and the Principles of Automatic Computation.

The author states that the book was developed from the standpoint of hand and desk-calculator techniques, and justifies this on the grounds of his belief that "the majority of workers in science and engineering can make great use of numerical methods without perhaps ever encountering a problem of sufficient length or complexity to justify programming it for an electronic computer." His final chapter, containing only eighteen pages about automatic computation, seems to confirm one's belief that the author views the modern field of numerical computation with automatic electronic computers as a spectator rather than as a participant.

D. M. Y.

University of Texas
Austin, Texas

3[G, S]. Taro Shimpuku, "General Theory and Numerical Tables of Clebsch-Gordan Coefficients," *Progr. Theoret. Phys.*, Kyoto, Japan, Supplement No. 13, 1960, p. 1–135.

General formulas for the Clebsch-Gordan coefficients $(j_1j_2m_1m_2 \mid j_1j_2jm)$, in the notation of Condon and Shortley [1], have been given by Wigner and by Racah [2], [3]. These formulas are very complex and computationally inconvenient. Shimpuku states: "Here we derive a new general expression of $C - G$ coefficients from the theory of spinor representation in three-dimensional rotation group, and this expression has a convenient form for practical evaluation (for any given values of the parameters)."

Algebraic formulas for these coefficients, for the special cases $j_2 = \frac{1}{2}$, 1, $\frac{3}{2}$, 2 are given in [1], p. 76–77; similar formulas for $j_2 = \frac{5}{2}$ and 3 are available in sources noted in the references in Shimpuku's paper. Shimpuku tabulates the algebraic formulas for $j_2 = \frac{7}{2}$, 4, $\frac{9}{2}$, and 5.

Numerical tables have been compiled, by Simon at Oak Ridge, for all cases where $j_1 \leqq \frac{9}{2}$, $j_2 \leqq \frac{9}{2}$. Over 100 pages of numerical tables are given by Shimpuku; these tables cover $j_2 = 5$, $\frac{11}{2}$, and 6 for all $j_1 \leqq 6$. Each entry is expressed as the radical of a rational fraction.

Shimpuku does not refer to the recent tabulation by Rotenberg et al. [4] of $3 - j$ symbols, from which the Clebsch-Gordan coefficients can be readily obtained. This tabulation covers all values $j_1 \leqq 8$, $j_2 \leqq 8$. However, for the range covered by Shimpuku, many users may find his rational fractions more convenient than the expressions as products of powers of primes used by Rotenberg.

George Shortley

Booz-Allen Applied Research, Inc.
Bethesda 14, Maryland

1. E. U. Condon & G. H. Shortley, *The Theory of Atomic Spectra*, Cambridge University Press, New York, 1935, p. 75.
2. E. P. Wigner, *Gruppentheorie und ihre Anwendung auf die Quantenmechanik der Atomspektren*, Friedrich Vieweg und Sohn, Braunschweig, 1931.
3. G. Racah, "Theory of complex spectra II," *Phys. Rev.*, v. 62, 1942, p. 438.
4. M. Rotenberg, R. Bivins, N. Metropolis & J. K. Wooten, Jr., *The 3-j and 6-j Symbols*, Technology Press, Cambridge, 1960. See *Math. Comp.*, v. 14, 1960, p. 382–383, Review 71.

4[I, X, Z]. National Physical Laboratory, *Modern Computing Methods*, Second Edition, Her Majesty's Stationery Office, London, 1961, 25 cm. Price $3.78.

This is the second edition of a booklet I praised highly when I reviewed its first edition (*MTAC*, v. 12, 1958, p. 230, Review 96). However, much has changed since then, and while I still feel that I shall recommend to every budding numerical analyst that he consult this booklet, I must add here to its list of limitations. I am tempted to say that it is "modern," much the same as Gilbert and Sullivan's Major General, but this would be entirely too harsh.

The booklet contains nothing about linear programming, assignment problems, or discrete variable calculations, which play a large role in computation, at least in the United States. (Beale in the United Kingdom might claim that these problems occur there also.) There is nothing about the Monte Carlo method which is very popular, at least in the southwest sections of the United States. (Hammersley in the United Kingdom might claim that these problems occur there also.) There is essentially nothing (nine lines of text, washing their hands of the whole subject) concerning latent roots and characteristic vectors of unsymmetric matrices, although some of these problems are vital in the study of stability. (This is most disappointing of all, for the workers at the National Physical Laboratory were spectacular in their early attacks on matrix problems and their reporting of their experiences.) There is a tendency to make overly dogmatic statements: "For hyperbolic equations the existence of real and distinct characteristics leads to the most satisfactory known method of numerical solution" (p. 105).

The listing of tables of functions of several variables is not adequately described. In particular, the alluring paper by Kolmogoroff [1] is not mentioned. In general, scant attention is paid to important Russian work; the book by Kantorovich and Krylov [2] is not listed in the bibliography, even though it is available in an understandable English translation.

Despite these criticisms, which might be likened to the disappointment of a lover (of the first edition) as his love ages, this is a handy booklet to have available. It is a cook book of procedures which are recommended on the experience of a perceptive, scholarly, and active computing group. It is less necessary now than it was when it was published in its first edition, for SHARE and the other users' groups have made experiences with computers more easily available to other users, but this booklet is more precise, less coding-conscious, and more scholarly than the reports of the users' groups. The booklet has been brought up to date on the topics it covers; Givens and Householder on latent roots are quoted carefully, including a British interpretation of their impressive work in both avoidance of long calculation and analysis of error. On the other hand, many reports of computational experience now exist in the literature, which was not the case when the first edition was published, so the booklet is no longer a must.

I would feel unhappy if I knew of this volume and did not have it in my library. I suggest that firms which have spent millions of dollars on computers buy a few copies even though some isomorph of SHARE is available.

If a third edition is contemplated, I suggest that the chapter on Finite Difference Methods be omitted as non-modern. By implication above, I have suggested chapters which should be included. Also a chapter on coding and coding languages might reasonably be added.

I note that there is considerable modernization of outlook (including a chapter on Chebyshev series), and this is good.

C. B. Tompkins

University of California
Los Angeles 24, California

1. A. N. Kolmogorov, "O predstavlenii nepreryrnykh funktsiĭ neskopkikh peremennykh v vide superpozitsii nepreryvnykh funktsiĭ odnogo peremennogo i slozheniia" ("On the representation of a continuous function of several variables in the form of a superposition of continuous functions of one variable and their sums"), Akad. Nauk SSSR, *Doklady*, 1957, v. 114, p. 953–6.

2. L. V. Kantorovich & V. I. Krylov, *Approximate Methods of Higher Analysis*, translated by Curtis Benster, Noordhoff, Groningen, 1958.

5[K]. G. W. Rosenthal & J. J. Rodden, *Tables of the Integral of the Elliptical Bivariate Normal Distribution over Offset Circles*, LMSD-800619, Lockheed Missiles and Space Division, Sunnyvale, California, May 1961, iii + 92 p., 28 cm.

These tables give the probabilities of being inside various circles not about the mean from a bivariate normal distribution having unequal variances. The range of the tables includes values of the mean up to three times the standard deviation.

Author's Summary

6[**K, X**]. V. V. SOLODOVNIKOV, *Introduction to the Statistical Dynamics of Automatic Control Systems*, Translation edited by John B. Thomas and Lotfi A. Zadeh, Dover Publications, New York, 1960, xx + 307 p., 20 cm. Price $2.25 (Paperbound).

This book, first published in Russian in 1952, gives an excellently written, self-contained account of the principles of the analysis of linear systems, the statistics of random signals, and the theory of linear prediction and filtering. The translation is well done. In addition to treating exact methods, the author discusses methods of obtaining approximate solutions to various problems.

The first three chapters are devoted to a discussion of the theory of the transients in a linear system produced by deterministic signals, to the elements of probability theory, and to the basic concepts of the theory of stationary random processes.

Chapter IV discusses the criterion of least mean-square error. Linear and square-law detectors are used to show how some nonlinear systems may be treated.

In Chapter V the problem of using numerical methods to approximate spectral distribution curves is treated.

Chapters VI, VII, and VIII contain the derivation and application of formulas from which one may obtain the transfer function yielding a minimum mean-square error from the knowledge of the spectral densities of the signal and noise. The last of these chapters treats the case where the signal is composed of two parts, one deterministic and one random.

The book contains four appendices. Appendix I consists of five-place tables of the functions $\frac{\sin x}{x}$ and $\frac{\cos x}{x}$ for $x = 0(.01)10.0(.1)20(1)100$. Appendix II contains tables of the first five Laguerre functions to five significant figures for values of the argument in the range 0(.01)1.0(.1)20(1)30. Appendices IIIa and IIIb give five-place tables for the calculation of the so-called phase characteristic function from straight-line approximations of the logarithm of the spectral-density function. Appendix IV gives a table of integrals

$$I_n = \frac{1}{2\pi j}\int_{-\infty}^{\infty} \frac{G_n(jw)}{H_n(jw)H_n(-jw)}\,dw,\ n = 1(1)7,$$

where

$$G_n(jw) = b_0(jw)^n + b_1(jw)^{n-1} + \cdots + b_n\,,$$
$$H_n(jw) = A_0(jw)^n + A_1(jw)^{n-1} + \cdots + A_n\,,$$

and all roots of $H_n(jw)$ are in the upper half-plane.

A. H. T.

7[**L**]. DAVID J. BENDANIEL & WILLIAM E. CARR, *Tables of Solutions of Legendre's Equation for Indices of Nonintegral Order*, University of California Lawrence Radiation Laboratory, Livermore, UCRL-5859, September, 1960, 68 p., 28 cm. Available from the Office of Technical Services, Washington 25, D. C. Price $1.75.

We employ the usual notation for hypergeometric and Legendre functions [1]. Let

$$f_1(x) = {}_2F_1(-\nu/2, \nu/2 + \tfrac{1}{2}; \tfrac{1}{2}; x^2); \quad f_2(x) = x\,{}_2F_1(\tfrac{1}{2} - \nu/2, 1 + \nu/2; 3/2; x^2).$$

Then $f_1(x)$ and $f_2(x)$ satisfy the differential equation

$$(x^2 - 1)\, d^2f/dx^2 + 2x\, df/dx - \nu(\nu + 1)f = 0,$$

and we have

$$P_\nu(x) = a_1 f_1(x) + a_2 f_2(x), \qquad Q_\nu(x) = b_1 f_1(x) + b_2 f_2(x),$$

where

$$a_1 = \pi^{1/2}[\Gamma(\tfrac{1}{2} - \nu/2)\Gamma(1 + \nu/2)]^{-1}, \quad a_2 = -2\pi^{1/2}[\Gamma(\tfrac{1}{2} + \nu/2)\Gamma(-\nu/2)]^{-1}$$

$$b_1 = -\frac{\tfrac{1}{2}\pi^{1/2}\Gamma(\tfrac{1}{2} + \nu/2)\sin \nu\pi/2}{\Gamma(1 + \nu/2)}, \quad b_2 = \frac{\pi^{1/2}\Gamma(1 + \nu/2)\cos \nu\pi/2}{\Gamma(\tfrac{1}{2} + \nu/2)}.$$

Table 1 gives $f_1(x)$ to 5S, corresponding to $x = 0(0.01)0.99$, $\nu = 0(0.0625)1(0.125)10(0.25)36$.

For a given ν, let $\alpha_i^{(\nu)}$ be the i-th zero of $f_1(x)$. Then Table 2 gives 4S values of $\alpha_i^{(\nu)}$ and of the integrals

$$\int_0^{\alpha_i^{(\nu)}} f_1(x)\, dx, \quad \int_0^{\alpha_i^{(\nu)}} \{f_1(x)\}^2\, dx, \quad \text{for} \quad \nu = 0.4375(0.0625)36.$$

Tables 3 and 4 present corresponding data for $f_2(x)$.

The tables are essentially new, and were obtained on an automatic computer. An introduction gives a few definitions (the coefficients a_1 and a_2 in the formula for $P_\nu(x)$ contain typographical errors). There is no discussion of formulas used to perform and check the calculations. No attempt is made to give closed-form results, which would be useful to the applied worker. For example, we can show that

$$f_1(x) = (\cos\theta/2)^{-1/2} \cos\left\{N_1\theta + \frac{1}{16N_1}(\tan\theta/2 + \theta/2)\right\}\{1 + O(1/\nu^2)\},$$

$$\int_0^x f_1(t)\, dt = (2N_1)^{-1}(\cos\theta/2)^{1/2} \sin\left\{N_1\theta + \frac{1}{16N_1}(-3\tan\theta/2 + \theta/2)\right\} \cdot\{1 + O(1/\nu^2)\},$$

$$f_2(x) = (2N_2)^{-1}(\cos\theta/2)^{-1/2} \sin\left\{N_2\theta + \frac{1}{16N_2}(\tan\theta/2 + 9\theta/2)\right\} \cdot\{1 + O(1/\nu^2)\},$$

$$\int_0^x f_2(t)\, dt = -(2N_2)^{-2}(\cos\theta/2)^{1/2} \cos\left\{N_2\theta + \frac{3}{16N_2}(-\tan\theta/2 + 3\theta/2)\right\} \cdot\{1 + O(1/\nu^2)\}$$

$$N_1^2 = \nu(\nu + 1)/4, \quad N_2^2 = (\nu - 1)(\nu + 2)/4, \quad x = \sin\theta/2, \quad 0 \leqq \theta < \pi.$$

Indeed, using these results, we have spot checked the entries. Tables 1 and 3 and values of the zeros of f_1 and f_2 in Tables 2 and 4 appear to be correct.

If $\nu = 20$, and $\alpha = 1, 2, 3$, the values of $\int_0^{x_\alpha} f_1(t)\, dt$ are erroneous, as is also the value of $\int_0^{x_1} f_1^2(t)\, dt$. It is curious that the error in each case is about 0.0021.

Similar check calculations for $f_2(x)$ reveal a persistent error of about 0.0024. Thus the tables of the numerical values of the integrals should be used, if at all, with caution. We have corresponded with one of the authors (D.J.B.). He has checked those entries in Tables 1 and 3 against known values of Legendre polynomials and finds that they are correct. The reason for the bias in the values of the integrals is not known, but he suspects that it arises from the binary-to-decimal conversion. We conclude with the "trite" observation that automatic computers cannot be trusted implicitly, and that the need for analysis and checking remains.

Y. L. L.

Midwest Research Institute
Kansas City, Missouri

1. A. Erdélyi, et al., *Higher Transcendental Functions*, Vol. 1, McGraw-Hill, New York, 1953.

8[L]. Ludo K. Frevel & J. W. Turley, *Tables of Iterated Sine-Integral*, The Dow Chemical Company, Midland, Michigan, 1961. Deposited in UMT File.

Three tables of decimal values of the iterated sine-integral, $Si\ (x)$, are herein presented, as computed on a Burroughs 220 system supplemented by Cardatron equipment, which permitted on-line printing of the results in the desired tabular format.

Table 1 presents the values of $Si\ (x)$ to 9D for $n = 1(1)10$, $x = 0(0.2)10$. Table 2 gives values of this function to 7D for $n = 0(0.05)10$, π, 2π, 3π, and Table 3 gives for $n = 1(1)10$ the values to 9D of the first thirty extrema, which correspond to $x = m\pi$, where $m = 1(1)30$.

In an accompanying text of three pages the authors describe in detail the method of calculation and the underlying mathematical formulas. It is there stated that the entries in Table 2 were computed to 9D prior to rounding. The entries in Table 3 are claimed to be accurate to within a unit in the final decimal place, and the authors imply in their explanatory text that comparable accuracy was attained in the computation of the entries in Table 1.

The tabular data corresponding to the values of n different from unity constitute an original contribution to the literature of mathematical tables.

J. W. W.

9[L, X]. Hans Sagan, *Boundary and Eigenvalue Problems in Mathematical Physics*, John Wiley & Sons, Inc., New York, 1961, xviii + 381 p., 24 cm. Price $9.50.

This attractive newcomer to the ranks of the textbooks on methods of mathematical physics comes to us directly from Moscow (where, for the past four years, the author has been an Associate Professor of Mathematics at the University of Idaho). This book contains material which has been used in the author's classes to seniors and beginning graduate students in mathematics, applied mathematics, physics, and engineering for the past five years. The author's stated purpose is not to present a vast number of seemingly unrelated mathematical techniques and tricks that are used in the mathematical treatment of problems which arise in physics and engineering, but rather to develop the material from a few basic concepts; namely, Hamilton's principle together with the theory of the first variation, and Bernoulli's separation method for the solution of linear homogeneous partial differential equations. The author's persuasive style appears certain to gain adherents for his viewpoints on many college campuses this coming fall.

Hamilton's principle and the theory of the first variation occupy Chapter 1. The representation of some physical phenomena by partial differential equations (vibrating string and membrane, heat conduction and potential equation) forms the subject matter of Chapter II. Chapter III contains general remarks on the existence and uniqueness of solutions and the presentation of Bernoulli's method of separation of variables, while Chapter IV is devoted to Fourier series. Chapter V deals with self-adjoint boundary-value problems, the concept of their eigenvalues being developed according to the elementary method of H. Pruefer in *Mathematische Annalen*, v. 95 (1926). Chapters VI and VIII, on special functions, deal with Legendre polynomials and Bessel functions, and spherical harmonics, respectively. Chapter VII develops the characterization of eigenvalues by a variational principle; while the final Chapter IX is devoted to the nonhomogeneous boundary-value problem (Green's function and generalized Green's function).

The text is well designed for class room use. The author intends it to be used in a two-semester three-credit course. Each chapter is generously provided with interesting exercises (answers and hints are provided at the end of the book for the even-numbered problems). A recommended supplementary reading list concludes each chapter. A welcome innovation is the detailed appendix, containing a condensation of topics with which "the student who wishes to take this course with a reasonable chance to succeed should be familiar."

J. B. Diaz

The University of Maryland
College Park, Maryland

10[S]. Charles DeWitt Coleman, William R. Bozman & William F. Meggers, *Table of Wavenumbers*, Volumes I and II, U. S. Department of Commerce. Volume I—2000 A to 7000 A, and Volume II—7000 A to 1000 μ, 1960, vii + 500 p., and vii + 534 p., 35 cm. Price $6.00.

A two-volume table for converting wave lengths in standard air to wave numbers in vacuum was computed by using the equation $\sigma_{\text{vac}} = 1/(n\lambda_{\text{air}})$, where n was computed from Edlen's 1953 equation for the refractive index of air. Wave numbers are given to the nearest 0.001 K (cm^{-1}) for wave lengths from 2000 to 7000 A in volume I, and 7000 A to 1000 μ in volume II. Proportional tables are given for linear interpolation between entries of λ. Also included are the vacuum increase in wave length, $(n - 1)$, and the refractivity of standard air in the form $(n - 1) \times 1000$.

Authors' Summary

11[W]. Guy H. Orcutt, Martin Greenberger, John Korbel & Alice M. Rivlin, *Microanalysis of Socioeconomic Systems: A Simulation Study*, Harper & Brothers, New York, 1961, xviii + 425 p., 21 cm. Price $8.00.

In this book the authors discuss an experimental calculation carried out on a high-speed calculator for the purpose of predicting the population trend during the period 1950 to 1960. The calculation is based on an elaborate model which is designed to simulate the demographic characteristics of the population by means of a large number of typical household units (approximately 5000). Each household unit represents a segment of the population, such as the married white female members between the ages of 20 and 25. The calculation proceeds in short time increments (months) until the final state is reached. The distribution of the population is computed at each time interval, taking into consideration the probabilities for such occurrences as births, deaths, divorces, etc. This process may be compared to the use of the Monte Carlo method for the solution of the diffusion equations in physics.

The reviewer believes that the authors would have better served the interests of future research in this field if they had devoted their discussion to a factual description of the results attained and difficulties encountered in carrying out this interesting but rather restricted experiment. However, as indicated by the somewhat pretentious title, this is not the primary emphasis of the book. The authors appear to stress the potential application of their techniques in the simulation of the total social-economic structure of the United States; and the book is promoted as a "pioneer work with a new approach to the scientific study and analysis of social systems, employing the major tools of modern research." The enthusiasm of the authors for their methods would have been more easily understandable if their calculations would have accurately predicted what the population distribution will be in 1970, rather than what it was in 1960.

H. P.

12[W, X]. Melvin Dresher, *Games of Strategy: Theory and Applications*, Prentice-Hall, Inc., Englewood Cliffs, New Jersey. 1961, xii + 186 p., 23 cm. Price $9.00.

This small volume on zero-sum two-person games contains essentially the whole story on finite games and a great deal on infinite games. It can be profitably read by anyone with some calculus and the first chapter or so of matrix theory behind him. The author presents an elementary proof of the minimax theorem which also yields a good computational procedure for solving finite games. The properties of optimal strategies are then discussed in an exhaustive and illuminating manner, and various methods of solving games are described. The subject of infinite games, filling one-half the book, is treated next, and the topics covered include games with convex payoff functions, games of timing, and games with separable payoff functions. Numerous examples of such games, described in military terms, are given and their solutions discussed thoroughly. The author's style is pleasant, and the printing and layout of the book are attractive.

Joseph Bram

Applied Mathematics Laboratory
David Taylor Model Basin
Washington 7, D. C.

13[X, Z]. L. Layton, H. Smith & L. Chatfield, *Proceedings of Executive Seminar on the Use of High-Speed Calculators for the Solution of Naval Problems*, Applied

Mathematics Laboratory, David Taylor Model Basin, Washington 7, D. C., DTMB Report 1519, May 1961, iv + 355 p., 27 cm.

This book consists of twenty unclassified papers presented at a seminar at the Applied Mathematics Laboratory, David Taylor Model Basin, Carderock, Maryland, during 7–9 September 1960. Six additional papers classified "Secret" and one classified "Confidential" are not included in this volume.

The papers are oriented toward the use of high-speed computers in the solution of Naval Problems, with emphasis on applications drawn primarily from the Bureau of Ships activities. The general areas covered are: (1) engineering research, (2) management data analysis, (3) large-scale data processing, (4) operations research, and (5) tactical and strategic planning.

The text is double-spaced and easy to read; however, the quality of reproduction of the photographs leaves much to be desired.

There is not enough space to review each paper separately, so that the following statements may do some injustice to individual papers. Several authors report on their own practical experience, and do not give a perspective to the subject discussed. However, there are many excellent papers, especially "Computer Technology Outside the USA" by Dr. S. N. Alexander, "Nuclear Reactor Design Calculations" by Joanna Wood Schot, "Mathematical Calculation of Shiplines" by Dr. F. Theilheimer, "The Solution of Naval Problems on High-Speed Calculators" by Dr. H. Polachek, and several others. The paper, "On Teaching of Mathematics," by Dr. Francis D. Murnaghan, should be read by every mathematics teacher. All in all, the book offers valuable reading for both the beginner and the experienced computer specialist.

It is unfortunate that the remarks of the keynote speaker, Professor Howard H. Aiken were not recorded for this volume, since he is recognized as the father of modern computers.

Ralph A. Niemann

U. S. Naval Weapons Laboratory
Dahlgren, Virginia

14[Z]. Wilhelm Kämmerer, *Ziffernrechenautomaten*, Akademie-Verlag, Berlin, 1960, viii + 303 p., 24 cm. Price DM 29.

This well-written book is based on a course of lectures given by the author at the Friedrich-Schiller University, in Jena. It discusses computer components, their organization into the various organs of a computer, the logical organization of computers, and the fundamentals of programming.

The first chapter discusses the binary number system and Boolean algebra. The second chapter is concerned with the nature of arithmetic operations and methods for realizing them by automatic devices.

Chapter three deals with the structure of an automatic computer and the requirements that must be imposed on it. It illustrates these requirements and methods by which they have been satisfied, by reference to various computers.

Chapter four discusses in some detail various well-known computer components and methods for organizing them into computer organs. The newer components are not treated.

The final chapter, Chapter five, is devoted to the principles of programming. Several illustrative problems are coded for an imaginary single-address machine. The problems of using a library of subroutines are discussed, as are the notions of relative addresses and floating addresses

The bibliography given at the end of the book is not an extensive one. The oldest references in it are dated 1951. This is somewhat unfortunate, for the reader cannot gain any impression therefrom of the historical development of the subject. The omission of any reference to the fundamental work of von Neumann on computers is, to the reviewer, a great oversight.

A. H. T.

15[Z]. Herbert D. Leeds & Gerald M. Weinberg, *Computer Programming Fundamentals*, McGraw-Hill Book Company Inc., New York, 1961, ix + 368 p., 23 cm. Price $8.50.

Nominally an introductory textbook on digital computing techniques and applications, this book presents a readable account of the basic principles of programming and coding for a specific machine, namely, the IBM 7090 computer. No mathematical knowledge beyond elementary algebra is required. The first section delineates the fundamental characteristics and special capabilities of a computer and then highlights the preparatory steps required to obtain a machine solution. The longer second section is devoted to an exposition of flow-diagramming and coding for the IBM 7090 computer.

In view of the fact that the book is addressed to "students in business administration, economics, and other nontechnical fields as well as the physical sciences and mathematics courses", the authors are disappointingly vague on the subject of programming techniques and procedures for the solution of large-scale data processing problems. Such significant developments as business compilers (COBOL, IBM Commercial Translator, etc.), sort generators, and report generators are not even mentioned. The value of the book as a general text on computer fundamentals is further lessened by the omission of references and supplemental readings. Consequently, the reviewer believes that this volume will be primarily suitable as a general IBM 7090 programming manual for nontechnical readers. It is written in a lively, lucid style that can be easily comprehended by the layman.

Milton Siegel

Applied Mathematics Laboratory
David Taylor Model Basin
Washington 7, D. S.

16[Z]. W. W. Peterson, *Error-Correcting Codes*, The Technology Press and John Wiley & Sons, Inc., New York, 1961, x + 285 p., 24 cm. Price $7.75.

The journal literature on algebraic coding theory has become so extensive lately that a book has been needed to give perspective and order to the field. This excellent book not only fills this need but also improves greatly on the presentation in many of the journal articles. In conjunction with the literature on probabilistic schemes of coding and decoding, Peterson's book gives an essentially complete picture of coding theory as currently known. Most of the material does not appear elsewhere in book form, and a considerable amount is original.

The style of writing is remarkably successful in developing insight and intuition without appreciably sacrificing rigor or conciseness. The book is almost self-contained and includes a development of the required algebraic concepts and theorems. A discussion of ways to implement algebraic operations, particularly on polynomials and Galois field elements by shift register circuits, should help the engineer to understand and use modern algebra, both in coding theory and elsewhere.

The first part of the book discusses linear codes, which are group codes or parity-check codes generalized to include non-binary alphabets. This includes a general treatment, some theoretical bounds on error-correcting ability, and a discussion of several specific classes of linear codes. Next, after some mathematical development, the theory and implementation of cyclic codes is discussed from several different viewpoints.

Bose-Chaudhuri codes, which are the most important of the known algebraic codes, are elegantly treated after cyclic codes. A simple derivation of their error-correcting capabilities is given, and two decoding techniques are presented. The remainder of the book treats burst-error correction, other approaches to decoding, recurrent codes, and the checking of arithmetic operations.

The appendices include a table of irreducible polynomials over the field of two elements. They are arranged in order as minimum polynomials of the elements of Galois field, and this makes it possible to find generator polynomials for Bose-Chaudhuri codes almost by inspection.

The book is highly recommended to engineers and mathematicians interested in coding, information theory, communication, and computers.

R. G. Gallager

Massachusetts Institute of Technology
Cambridge 39, Massachusetts

17[Z]. A. Ungar, Proceedings Editor, *Proceedings of the 1959 Computer Applications Symposium*, sponsored by the Armour Research Foundation of Illinois Institute of Technology, Chicago, 1960, x + 155 p., 23 cm. Price $3.00.

Like most symposia, this little book contains quite a variety of papers, some of them excellent, and some of them only mediocre. The paper entitled "Fortran Experience and Remote Operation by Non-computer Specialists" in conjunction with its subsequent panel discussion is, in the opinion of this reviewer, alone well worth the price of the book. This is by no means the only interesting paper. Each paper is followed by the type of bantering discussion that usually takes place in a meeting of a group of specialists.

The papers include: "Shareholder Record-Handling with the Aid of Character-Recognition Equipment," "Around the World in Eighty Columns," "Cost Reduction Through Integrated Data-Processing," "Some Aspects of Computer Technology in the USSR," "Experience and Plans for Marketing-Research Operations," "A Modern Approach to Inventory Control Utilizing a Large-Scale EDPM," "Current Developments in Common-Language Programming for Business Data Systems," "Linear Programming on the Bendix G-15 Computer," "The Design and Use of the APT Language for Automatic Programming of Numerically Controlled Machine Tools," "A Quasi-Simplex Method for Designing Suboptimum Packages of Electronic Building Blocks," "The International Algebraic Language and the Future of Programming," "Training for Engineers and Scientific Applications via Compilers, Interpreters, and Assemblers," "Scientific Design Procedure Utilizing a Small Computer," and "FORTRAN Experience and Remote Operation by Non-Computer Specialists."

This inexpensive book is recommended for inclusion in the libraries of computation laboratories and of individual programmers.

RICHARD V. ANDREE

University of Oklahoma
Norman, Oklahoma