REVIEWS AND DESCRIPTIONS OF TABLES AND BOOKS

67[A].—J. B. Reid & G. Montpetit, *Table of Factorials 0! to 9999!*, Publication 1039, National Academy of Sciences-National Research Council, Washington, D. C., 1962, 47p. (unnumbered), 28 cm. Price $1.50.

This table gives $n!$ in floating-point form to 10S for $n = 0(1)9999$. The exact values of $n!$ may be inferred through $n = 15$; beyond that point all the entries are rounded, approximate numbers.

We are informed in the introduction that this table was prepared in response to a request for appropriate data for the calculation of the hypergeometric distribution involving numbers exceeding 1000. For numbers not exceeding this limit, tables of factorials to 16S by Salzer [1] and 20S by Reitwiesner [2] are available. The authors, however, make no reference to these tables or any others in this field.

The calculations were carried out to 20S on an IBM 650 system, working with 30-digit products prior to truncation. The printing was done on an IBM 407 accounting machine, and no checks were applied to the printed output. On the other hand, the IBM 650 calculations were performed twice; the first time, without rounding to 20S; and the second time, adding a unit in that place prior to dropping the subsequent figures. The two values of 9999! thus obtained are displayed to 20S, and agreement to 15S is noted. This reviewer has independently computed this factorial to more than 25S; his result differs by less than 9 units in the twentieth place from the average of the two values discussed by the authors. Accordingly, the tabulated results should be reliable, except for the possibility of misprints, as the authors state.

The reviewer has compared the first thousand entries in this table with corresponding values in the table of Salzer, and has detected no discrepancies.

With respect to approximate values of the factorial function corresponding to integer values of the argument exceeding 1000, the present table constitutes a unique and valuable contribution to the literature of mathematical tables.

J. W. W.

1. H. E. Salzer, *Tables of n! and $T(n + \frac{1}{2})$ for the First Thousand Values of n*, National Bureau of Standards, AMS 16, Washington, 1951. (*MTAC*, v. 6, 1952, p. 33, RMT **957**).
2. G. W. Reitwiesner, *A Table of the Factorial Numbers and their Reciprocals from 1! through 1000! to 20 Significant Digits*, Ballistic Research Laboratories, Technical Note No. 381, Aberdeen Proving Ground, Md., 1951. (*MTAC*, v. 6, 1952, p. 32, RMT **955**.)

68[A, B].—H. T. Davis & Vera J. Fisher, *Tables of the Mathematical Functions: Arithmetical Tables*, Volume III, Principia Press, San Antonio, Texas, 1962, ix + 554 p., 25.5 cm. Price $8.75.

The "Volume III" in the title has reference to two well-known volumes [1] of Professor Davis published long ago. The present volume is of different character, however, as is indicated in the deletion of the word "higher" from the title. Its main bulk is in the following twelve tables, mostly of powers and roots:

Table 1 gives constants associated with π, e, γ, and certain roots and logarithms to a precision varying from 10D to 45D.

Table 2 lists n^2 and n^3 for $n = 1(1)10{,}000$.

Table 3 gives values of n^{-1} to 15D for $n = 1(1)100$ and to 17D for $n = 100(1)1000$. The second-order central difference is included.

Table 4 lists n^{-1} to 10S for $n = 1000(1)10{,}000$, together with first differences.

Table 5 contains values of m/n for $n = 2(1)101$ and $m < n$ to 10D.

Table 6 lists $x^{1/2}$ and $(10x)^{1/2}$ to 12D for $x = 1(1)1000$ with first differences.

Table 7 gives the same quantities to 6D for $x = 1000(1)10{,}000$.

Table 8 consists of $x^{1/3}$, $(10x)^{1/3}$, and $(100x)^{1/3}$ to 12D for $x = 1(1)1000$ with first differences.

Table 9 lists $x^{1/3}$ to 6D for $x = 1000(1)10{,}000$ with first differences.

Table 10 contains $x^{\pm 3/2}$ to 10D with first differences.

Table 11 shows the binomial coefficients ${}_nC_r = n!/r!(n - r)!$ for $n = 4(1)100$. Also given are ${}_{-n}C_r$ for $n = 1(1)10$ and ${}_nC_r$ for 22 fractions $n = \pm k/l$ with $l = 2(1)6$, k less than and prime to l.

Table 12 lists x^n for $n = 2(1)12$ and $x = 1(1)100$.

The authors do not indicate which of these tables have been newly computed and which have been compiled from previous publications. Tables 2, 7, and 9, which comprise more than one-half of these pages, are contained in the well-known *Barlow's Tables* [2], but the format here is more generous. Table 10, and perhaps Tables 8 and 3, appears to be original. The remaining tables can be found in various books, some of which, however, are long out of print.

The tables are preceded by a 96-page text in four chapters: "The Arithmetic Functions," "Mathematical Constants," "The Solution of Equations," and "Transcendental Equations".

The second chapter contains histories of π, e, γ, $\log_e \pi$, $\log_{10} e$, and some other numbers. These histories extend to about 1950 only; the NORC value of π (1955), Wheeler's value of e (1953), Wrench's value of γ (1952) and later values are not mentioned. The history of π ends with "the ENIAC computed π to the fantastic approximation of 2035 decimal places." In view of a more recent computation [3], the undersigned is reminded of an old quotation. In his first publication concerning π (1853), William Shanks remarks [4]:

". . . Previous to 1831, the value of π, as the late Professor Thomson of the University of Glasgow writes, in his work on the Differential and Integral Calculus, had been calculated 'to the extraordinary extent of 140 figures!' We may here be permitted to indulge a smile at the learned writer's words, now that the ratio has been found to 607 places of decimals!"

In the third chapter two tables of $z^3 - z$ are included to facilitate the solution of cubic equations. These are for $z = 1.0000(.0001)1.2009$ to 10D and $z = 0.00(.01)10.50$ to 6D.

Several places in the text the designation "Encyclopedia" is given to the present volume together with the two previous ones [1]. But the planned extent of the "Encyclopedia" is not revealed.

For the subject matter of this third volume the reader is also referred to the following review.

D. S.

1. Harold T. Davis, *Tables of the Higher Mathematical Functions*, Vol. I and Vol. II, Principia Press, Bloomington, Indiana, 1933 and 1935.

2. L. J. COMRIE, editor, *Barlow's Tables*, 4th edition, Chemical Publishing Co., New York, 1941.
3. DANIEL SHANKS & JOHN W. WRENCH, JR. "Calculation of π to 100,000 Decimals," *Math. Comp.*, v. 16, 1962, p. 76–99.
4. WILLIAM SHANKS, *Contributions to Mathematics, comprising chiefly the Rectification of the Circle to 607 places of decimals*, G. Bell, London, 1853.

69[A, B].—C. B. BAILEY & G. E. REIS, *Tables of Roots of the First Ten Thousand Integers*, Sandia Corporation Monograph, SCR-501, January 1963, 237 p., 28 cm. Price $3.00. Available from the Office of Technical Services, Department of Commerce, Washington 25, D. C.

Table I lists $N^{1/2}$, $(10N)^{1/2}$, $N^{1/3}$, $(10N)^{1/3}$, $(100N)^{1/3}$, $N^{1/4}$, $(10N)^{1/4}$, $(100N)^{1/4}$, and $(1000N)^{1/4}$ for $N = 1(1)\ 10{,}000$ to 9D.

Table II lists $N^{1/k}$ for $k = 2(1)\ 10$ and $N = 1(1)1000$ to 9D.

Table III lists $x^{1/k}$ for $k = 2(1)10$ to 11D for 48 values of x such as π, π^{-1}, e, γ, $\pi^{1/e}$, $e^{1/\pi}$, etc. In striving for symmetrical completeness, $x = \log_e 10$ and $x = (\log_{10} e)^{-1}$ are both given. Luckily, the values in these two lists coincide.

The tables were computed on a CDC 1604 with a double-precision Newton-Raphson iteration, starting from a single-precision Fortran approximation. All values were carefully rounded (in decimal). The values listed were very carefully checked in two different ways. The format is very good.

The authors are to be commended for their conscientious effort. We have seen so many machine-made tables in the past years with poor error control, mediocre format, etc., that a carefully produced table draws attention to itself at once, as the sort of thing possible if the necessary care is taken.

D. S.

70[A–E, J, M].—ROBERT D. CARMICHAEL & EDWIN R. SMITH, *Mathematical Tables and Formulas*, Dover Publications, Inc., New York, 1962, viii + 269 p., 21.5 cm. Price $1.00.

As explicitly stated by the publisher, this is an unabridged, unaltered, paperback edition of mathematical tables and formulas compiled by Carmichael & Smith and originally published by Ginn and Company in 1931.

The material is arranged in three parts. Part I consists of an introduction devoted to linear interpolation, the elementary properties of logarithms, and a brief description of some of the fourteen tables therein, which are "necessary in the study of college algebra and trigonometry." These tables include: common logarithms to 5D, arranged in a single-entry table; natural and logarithmic trigonometric functions to 4 and 5D; conversion tables for use with sexagesimal and radian angular measurement; and well-known constants, generally to 7 and 8D, except for π and e and their logarithms, which are separately listed to 30D.

Part II consists of five tables "not generally accessible to students of college mathematics," together with brief introductory explanations of their contents and use. These tables include: 6S values of $n^{-1}, n^2, n^3, n^{1/2}, (10n)^{1/2}, n^{1/3}, (10n)^{1/3}, (100n)^{1/3}$ for $n = 1(0.01)10$; $\ln n$ to 5D for $n = 0.01(0.01)10(0.1)100(1)1000$; $e^{\pm x}$, $\sinh x$, $\cosh x$, generally to 5S, and their common logarithms to 5D, for $x = 0(0.01)3(0.05)4(0.1)6(0.25)10$; the first 100 multiples of M and $1/M$ to 6D; and finally 10D common logarithms of primes less than 1000.