REVIEWS AND DESCRIPTIONS OF TABLES AND BOOKS

The numbers in brackets are assigned according to the indexing system printed in Volume 28, Number 128, October 1974, pages 1191–1194.

1[2.05].—C. A. MICCHELLI & T. J. RIVLIN, Editors, *Optimal Estimation in Approximation Theory,* Plenum Press, New York, 1977, ix + 300 pp., 25½ cm.

The papers in this volume were presented at an International Symposium which was held in Freudenstadt, Federal Republic of Germany, September 27–29, 1976.

2[2.05.5, 7.20, 7.25, 7.30, 7.45, 7.55, 7.75].—YUDELL L. LUKE, *Algorithms for the Computation of Mathematical Functions,* Academic Press, New York, 1977, xiii + 284 pp., 23½ cm. Price $15.00.

The main purpose of this book is to provide computer programs for generating three types of approximations to special functions: expansions in Chebyshev polynomials, rational approximations of the Padé type (those on the main diagonal of the Padé table), and certain other rational approximations not of the Padé type. Much of the underlying mathematical machinery has been presented by the author on previous occasions [1], [2], and is summarized, once more, in the present volume. What has been added, now, are computer programs written in FORTRAN IV for the IBM 370/168, which generate the expansion coefficients and the coefficients in the rational approximations, and provide tests for their accuracy. The programs are applicable to rather wide classes of special functions. Thus, Chapters 4–9 provide programs for generating Chebyshev expansions for the Gauss hypergeometric function ${}_2F_1(a, b; c; z)$ and its confluent forms ${}_1F_1(a; c; z)$, ${}_0F_1(c; z)$, as well as for the hypergeometric functions ${}_1F_2(a; b, c; z)$ and certain G-functions. Some of the expansions are of the "ascending" type,

$$f(z) = \sum_{n=0}^{\infty} C_n(w)T_n^*(t),$$

where T_n^* is the (shifted) Chebyshev polynomial of degree n, and $z = tw$, $0 \leqslant t \leqslant 1$, with w a fixed complex number, while others are of the "descending" type,

$$f(z) = \sum_{n=0}^{\infty} G_n(w)T_n^*(1/t), \qquad z = tw,\ t > 1.$$

There is considerable discussion of the asymptotic behavior of the coefficients $C_n(w)$ and $G_n(w)$ as $n \longrightarrow \infty$, which ought to be helpful in determining the number of terms required for any given accuracy. Similarly, Chapters 13–21 provide programs for generating rational approximations for hypergeometric and confluent hypergeometric functions, including Bessel functions and ratios of Bessel functions. Here again, there is a detailed account of the asymptotic behavior of the error as the degree of the rational approximation tends to infinity. Additional programs, more of a utility nature, are included in Chapters 11 and 12. Some generate Chebyshev expansions for such functions as $g(z) = e^{-az}z^{-u-1}\int_0^z e^{at}t^u f(t)\,dt$, if one furnishes the expansion for f; others convert