REVIEWS AND DESCRIPTIONS OF TABLES AND BOOKS

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

1 [2.30, 7.05].—RICHARD P. BRENT, *γ and e^γ to* 20700D *and Their Regular Continued Fractions to* 20000 *Partial Quotients*, Australian National University, 1976, 76 computer sheets deposited in the UMT file.

These are the four tables referred to in Brent's paper [1]. They give γ and e^γ to 20700D and their regular continued fractions

$$q_0 + \frac{1}{q_1} + \frac{1}{q_2} + \cdots \frac{1}{q_{20000}}$$

to 20000 partial quotients. For historical, computational and statistical details, see Brent's paper.

A paradoxical point in Brent's paper is this: He attributes to Euler the "suggestion that e^γ could be a more natural constant than γ". Euler should know and I might add that I am inclined to agree: certainly e^γ and $e^{-\gamma}$ occur more frequently in analysis. Now γ is known, by experience, to be harder to compute than π, and π is harder than e. Yet here Brent first computes γ by Sweeney's method, which is the most efficient known, and *then* he computes e^γ from γ. Why not reverse the order? So the question is: What occurrence of e^γ in analysis will lead to an efficient algorithm for its (direct) computation?

Originally, Brent computed γ to 10488D and when this was compared with the previous computation of γ by Beyer and Waterman a discrepancy between the two led to the discovery of an error in the value of Beyer and Waterman. A Table Errata in this issue gives details.

D. S.

1. RICHARD P. BRENT, "Computation of the regular continued fraction for Euler's constant," *Math. Comp*., v. 31, 1977, pp. 771–777.

2 [3.00, 4.00].—A. C. BAJPAI, I. M. CALUS & J. A. FAIRLEY, *Numerical Methods for Engineers and Scientists*, Taylor & Francis Ltd., London, 1975, xii + 380 pp., 25 cm. Price £6.75.

This is a course book written for undergraduates and engineering students. It emphasizes the practical side of the subject and the more theoretical aspects have been largely omitted. The book is unconventional in that it is a programmed text book. It is divided into three units: Unit 1 – Equations and Matrices, Unit 2 – Finite Differences and their Applications, and Unit 3 – Differential Equations. Each unit is then subdivided into programs (between 3 and 5) and each program consists of a sequence of frames (on the average 3 frames per page). Miscellaneous examples with answers and hints are given at the end of each program.

The topics are presented through a sequence of carefully chosen examples mostly with some physical or technical background. The reader first works through one or several numerical examples and then arrives at a more mathematical presentation of the method. The book reflects the authors' interest in educational technology and their experience in teaching mathematics to engineering students, who often do not have a very high mathematical ability and are in need of motivation.

In an introductory course book in an applied subject like this, it is useful to have a good list of references for those students who later want, or indeed must, complement their knowledge. Unfortunately the list given in this book is inadequate, and in fact fails to list almost all of the more popular textbooks that exist. The typography of the book is not very appealing and lack of easy to find headlines makes it unnecessarily difficult to find the results you are looking for. Fortunately, however, there is a useful subject index giving both page and frame number.

The overall content of the book corresponds, in general, well to what should be included in an introductory course for engineering students. There are some notable exceptions where the treatment is not up to modern standards, and I list some of these here. On p. 91 it is stated that the better of the two approximate solutions to a system of linear equations $Ax = b$, is the one for which $\|b - Ax\|_2$ is less. This choice, however, does not necessarily make the error in x small, and the choice must, in general, depend on one's criterion of goodness. Also, in Gaussian elimination rounding errors are *always* correlated so as to give a small residual, which is not the case for, e.g. Gauss-Jordan elimination. On p. 111, one of the advantages of Gauss-Seidel's iteration method over elimination is said to be that round-off errors generally have less effect. This was a widely held belief in "pre-Wilkinson times", but in fact the opposite is more true. Doolittle's algorithm for computing the LR-factorization (called Choleski's method by the authors) is introduced without pointing out that Gaussian elimination will produce the same L and R. It should also have been stated that the symmetric factorization $A = LL'$ works only when A is positive definite. In the program on least squares the normal equations are used throughout, without hinting at the numerical difficulties that can result. Indeed the use of a false origin is described, but this is said only to be useful for reducing the amount of arithmetic in hand calculations. In the program on interpolation I was surprised to see that divided differences are introduced at great length, but then only used to derive Lagrange's interpolation formula.

The fact that one can find details to criticize should not detract from the basic fact that this is a practical textbook to use for the group of students at which it is aimed. Whether you as a teacher will like this book probably depends on your own attitude to programmed education. The approach as used here certainly has advantages. It stimulates the student to work actively, and this should be a good text for self-instruction. For the students in the group with good mathematical abilities, the numerical examples may sometimes obscure rather than simplify many derivations. Often theoretical knowledge can be very practical to have, and I am not sure the authors always have found the right balance.

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3 [3.15].—G. GOOS & J. HARTMANIS, Editors, *Matrix Eigensystem Routines—EISPACK Guide,* 2nd ed., Lecture Notes in Comput. Sci., Vol. 6, Springer-Verlag, Berlin, 1976, vii + 551 pp. Price $17.30 paperback.

In 1971 J. H. Wilkinson and C. Reinsch published a set of Algol procedures for eigenvalue and eigenvector computations. From the mathematician's point of view, these algorithms settle the question of how these computations should be done (unless, of course, you disagree with the particular choice of algorithms). However, it is now widely recognized that it requires considerable effort and talent to turn good Algol procedures into programs that can be easily and widely used. Obviously, an Algol to Fortran translation must be made. In addition, to get top efficiency and reliability,