The algorithmic perspective is religiously followed, and a good deal of attention is paid to data structures for implementation. It is surprising, however, that analysis of time complexity is omitted for several algorithms. A good, though somewhat brief, introduction to easy (polynomially bounded) and hard (*NP*-complete or *NP*-hard) problems is included. The algorithmic style is pursued almost to the exclusion of theorems; the latter are merely stated in italics, with no separate numbering. While theorems scare some students, the style of this book may confuse more.

While theorems have only a small part, there is a good deal of mathematical abstraction and notation present. The book starts with an initial chapter of thirty pages on algebraic foundations, introducing binary operations and relations, orderings, and lattices. For such an intuitive subject as graph theory, it is unfortunate that graphs delay their appearance for so long. When they appear, they are "Berge" graphs; that is, all graphs are directed, while some (simple graphs) are directed both ways. The second chapter also introduces algorithms, for finding strong components, traversing trees, and determining Hamiltonian cycles, for instance. Eulerian circuits, however, are confined to an exercise.

The third chapter is the most original and interesting. The author defines "path algebras", with applications to listing paths or elementary paths and finding shortest or most reliable paths. He then demonstrates that such path problems can be expressed as linear equations over the appropriate path algebra. Methods of numerical linear algebra are then modified to solve these equations, leading to a synthesis of several well-known path algorithms.

Chapters four, five, and six are devoted respectively to connectivity, independent sets, covers and colorations, and network flow problems. Again, the emphasis is on algorithms. There is, for instance, no discussion of planarity or the 4-color theorem.

Each chapter concludes with additional notes and references that appear to be quite useful.

The book is intended for advanced undergraduate or beginning graduate courses. It is most accessible to students with some background in modern algebra and provides a fairly comprehensive description of algorithms for graph and network problems. To this reviewer, it seems that those students familiar with abstract algebra will be interested in more mathematical development, while those more interested in algorithms will be less inclined to the algebraic approach.

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4[2.00].—Irving Allen Dodes, *Numerical Analysis for Computer Science*, North-Holland, New York, 1978, ix + 618 pp., 26 cm. Price $19.95.

Since the present text covers typical subject matter to be found in many numerical analysis texts, the reviewer must try to discover features of the book which explain its title. The computer science curriculum (cf. *Comm. ACM*, March, 1979) lists two courses in numerical analysis as electives only. Although this text was developed for a full year course, the author suggests material to select from it for a one-term course. In either case, there would seem to be a limited market for the book among computer scientists.

Since computer scientists in the standard professional curriculum are required to have little mathematics beyond calculus and some acquaintance with linear algebra and since experience shows that many computer science majors are not too adept at these subjects, the author is no doubt well advised in explaining each mathematical concept without presuming too much retention from previous courses. The development of each mathematical concept is done in detail and explicitly.

In addition every opportunity is taken to explain as much mathematics as possible beyond the calculus level. Such topics include Taylor series in n-variables, Fourier series, summation by parts, and the Riemann zeta function. In the teacher's manual which accompanies the book, this tendency is even more in evidence. Fifteen topics in advanced mathematics are surveyed, including the integration of complex functions. In the text itself, matrix inversion, determinants, Cramer's rule, and eigenvalues are discussed in wholly self-contained expositions. One senses a laudable zeal on the author's part to repair the mathematical deficiencies in the computer science curriculum.

The chapters are: Introduction to Error Analysis, The Solution of an Equation, Systems of Linear Equations, Non-Linear Systems, Classical Interpolation Theory, Summation by Formula, The Taylor Series, Series of Powers and Fractions, The Fourier Series, The Chebyshev Criterion, Integration by Computer, First-Order Ordinary Differential Equations, Second-Order Ordinary Differential Equations.

A particularly useful and clear presentation is given of the Hastings procedures for finding polynomial and rational approximations to functions. At the end of the discussion of eigenvalues, two substantially different fourth-order characteristic equations are obtained by the Householder and Givens reductions, respectively, applied to the same tridiagonal matrix. Since the roots of the two polynomials are not obtained, the reader can only conjecture that the author wished to present an unsolved problem as an example. Although multiple precision is advised, the reader is left in suspense as to whether this was tried.

In the last section of the book a tridiagonal matrix is obtained in approximating a boundary value problem for a second order ordinary differential equation. This would have seemed to be the place to present the Gaussian elimination algorithm for a tridiagonal system, which is essential in presenting ADI procedures. However it is not stated in the text and the reader cannot puzzle out the method used to solve the system from the computer program since the program illustrating the Numerov method in the previous section is simply repeated.

Such topics of current interest as the Fast Fourier Transform, spline approximation, collocation methods, and stiff systems of ordinary differential equations are not included. Nor is any awareness shown of the availability of mathematical subroutine packages.

On page 442 the author apologizes for mentioning that Simpson's rule integrates a third-degree polynomial exactly and says "it would be senseless to use Simpson's rule to integrate a third-degree polynomial." May not the next generation come to feel that it is pointless to teach any integration techniques except numerical?

On page 451, an example is given of Richardson extrapolation applied to Simpson's rule. When a good answer is not achieved the author concludes that "we do not recommend this procedure." Later he praises Romberg integration as not being a Richardson extrapolation, contrary to the thinking of other authors.

On page 529, the author suggests that the simplest types of second-order ordinary differential equations are the most common in practice. It is true that simple types occur frequently in textbooks. One fears that the future computer scientist will be misled by such a remark since he will have no way of knowing that problems of weather prediction, modelling of oil reservoir behavior, and of nuclear reactors, which have been significant computer challenges, have not involved particularly simple types of equations.

However it is all too likely that such challenging problems will not be attempted by graduates of the standard computer science program unless they learn the necessary science and mathematics. To do this they must complete a different degree.

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5[7.95, 7.100].–I. S. GRADSHTEYN AND I. M. RYZHIK, *Table of Integrals, Series and Products*, Academic Press, New York, 1980, xlv + 1248 pp., 23 cm. Price $19.50. (Corrected and enlarged edition prepared by: Allan Jeffrey, incorporating the fourth edition prepared by: Yu. V. Geronimus and M. Yu. Tseytlin, translated from the Russian by Scripta Technica, Inc., and edited by Allan Jeffrey.)

The history of this work dates back to the 1943 tables (in Russian) by I. M. Ryzhik. It was reviewed in [1] and reviews of subsequent editions and notices of errata are covered in [2]–[17]. In 1957 there appeared a translation of the Russian third edition into parallel German and English text. It is an improved and expanded version of the 1943 edition and is authored by I. S. Gradshteyn and I. M. Ryzhik. This item was reviewed in [2] and errata are noted in [2]–[5], [10]. In 1965, the immediate forerunner of the present volume appeared. It represents an expanded version of the third edition with many new sections added. This was reviewed in [6] and errata notices are given in [7]–[9], [11]–[17].

The first 1080 pages of the 1965 and present editions are identical except for corrected errata and for some new errata introduced in place of the old errata. Yet much of the 1965 errata remains. Indeed two errata noted in [3] are in the 1965 and 1980 editions. Pages xxiii–xlv are also the same in both editions. Pages i–xxii are slightly different owing principally to the table of contents which describes the 73 pages of new material, (pp. 1081–1153) in the present edition. The list of bibliographic references used in preparation of text is slightly enlarged, but the classified supplementary references are the same. The bibliographies are seriously deficient in view of a large amount of significant material which has appeared in the last fifteen years.

On p. ix of the present edition there is an acknowledgement to 74 workers who