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.

5[2.45].—LYDIA I. KRONSJÖ, *Algorithms, Their Complexity and Efficiency*, John Wiley & Sons, Inc., New York, 1979, xv + 355 pp., $23\frac{1}{2}$ cm. Price $57.50.

Studying the efficiency and characteristics of algorithms is a natural concern of Computer Science and is by no means a recent field. However, in the last decade or so, the field has received particular attention due to the discovery of natural problems which are *intractable*. That is, although in principle computable, efficient algorithms for such problems do not exist or, to date, have not been found.

The mainstream of this more recent research has concentrated on studying problems from Combinatorics, Operations Research, Graph Theory, and Logic, and recent books and monographs on algorithms concentrate on one or more of these subjects. Problems from Number Theory and Algebra have been treated less frequently, although the (discrete) fast Fourier transform and the Schönhage-Strassen algorithm for integer multiplication are usually included. Kronsjö's book changes this style and studies algorithms with the focus on algebraic problems. This change is welcome, and the book fills a definite gap.

About two-thirds of the book are devoted to numerical problems and their algorithms. Treated are the evaluation of polynomials, finding a root by iterative methods, solving sets of linear equations, computing the Fourier transform, and multiplying integers. The problems are discussed in much detail and at an advanced level.

Now a digital computer must approximate real numbers. Consequently, a numerical algorithm for problems such as the ones listed above is not necessarily useful just because it is efficient. Of at least equal importance is the accuracy with which the "true" result is approximated. Typically, there is a time/accuracy trade-off: with more computing time greater accuracy can be had, and the nature of this trade-off is an important criterion of the usefulness of the algorithm. For example, an algorithm for finding the roots of a polynomial can be such that only for specific coefficient ranges the approximations to the root converge to the actual root, and this convergence could be rapid or slow. Thus, with numerical algorithms there are more practical concerns than solely the resources required by the computation. But there are also theoretical questions: For example, what is the smallest number of additions and of multiplications required to evaluate a polynomial of degree n.

The author discusses both the theoretical and the practical issues at the right level of detail, and only occasionally did I have the feeling that results could have been labelled more clearly as empirical or as a consequence of theoretical argument. The author seems to be well aware of recent research and the book is very informative.

©1982 American Mathematical Society
0025-5718/81/0000-1106/$02.00

Overall, I feel that the "numerical" part of the book is well-conceived and clearly presented. But I have a basic reservation about the book as a whole: First, I feel it should not make a half-hearted attempt to address mainstream topics as well, least of all sorting and searching, which is discussed in the last third of the book. These problems are surely fundamental, but they have received extensive and thorough treatment already, for example in [1]. Second, I miss a chapter on intractable problems. There are *NP*-complete problems which are purely number-theoretic, for example solving quadratic diophantine equations [2], and it seems natural to include them given the main thrust of the book. In fact, the author prepares the ground for such a section in the introduction by discussing how asymptotic complexity limits practical problem size, and it is unfortunate that this subject is not developed further. In short, I feel that the book would be stronger if the last third on sorting and searching were replaced by a discussion of hard algebraic problems.

At more than forty dollars, the book is not likely to be chosen as the textbook for a specialized course or seminar. This is a pity, since, by its content, it would be a natural choice.

CHRISTOPH M. HOFFMANN

Department of Computer Sciences
Purdue University
West Lafayette, Indiana 47907

1. D. KNUTH, *The Art of Computer Programming*, Vol. 3, Addison-Wesley, Reading, Mass., 1973.
2. K. MANDERS & L. ADLEMAN, "*NP*-complete decision problems for binary quadratics," *J. Comput. Systems Sci.*, v. 16, 1978, pp. 168–184.

6[2.05.6]. —LARRY SCHUMAKER, *Spline Functions: Basic Theory*, John Wiley & Sons, Inc., New York, 1981, xiv + 553 pp., $23\frac{1}{2}$ cm. Price $42.50.

This book will serve as an excellent reference on spline functions. It treats both the constructive and approximation-theoretic aspects of splines. The main tools used to describe the approximation properties of splines are the various moduli of smoothness and the *K*-functional. A certain amount of sophistication is required of the reader, since many results are stated without proof (but with adequate references). It is for this reason that I would urge caution to the person who wants to use this book as an introductory spline text.

Although univariate polynomial splines dominate nearly the first three-fourths of the book, there is one chapter each on Tchebycheffian Splines, *L*-Splines, Generalized Splines, and Tensor-Product Splines. In conclusion, I have no doubt that this well-written book will be appreciated not only by the experts in the field of spline approximation, but also by those serious students who wish to learn about splines.

P. W. SMITH

Department of Mathematics and Computer Science
Old Dominion University
Norfolk, Virginia 23508