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.

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

7[4.05, 5.05].—H. FUJII, F. KIKUCHI, T. NAKAGOWA & T. USHIJIMA (Editors), *Numerical Analysis of Evolution Equations*, Lecture Notes in Numerical and Applied Analysis, Kinokuniya, Tokyo, 1979, iv + 163 pp., 26 cm. Price $13.00.

This volume is the first in a series to appear under the title Lecture Notes in Numerical and Applied Analysis and edited by H. Fijita and M. Yamaguti. It consists of the following seven papers selected from lectures presented at the Symposium on Numerical Analysis—State of the Art of Finite Element Methods for Evolution Equations, held July 11–12, 1978 in Kyoto, Japan, and organized by the Computer and Analysis Seminar, Japan:

T. Ushijima, On the finite element type approximation of semi-groups of linear operators

M. Tabata, L^{∞}-analysis of finite element method

T. Suzuki, On some approximation theorems of evolution equations of parabolic type

T. Nakagawa, Transformation-into-finite-domain (TIFD) method for the finite difference solution to the diffusion equation in R^2

T. Iwamiya, S. Oharu and T. Takahashi, On the semigroup approach to some nonlinear dispersive equations

K. Goda, A finite difference scheme for the regularized long wave equation

J. Watanabe, Approximatiion of nonlinear problems of a certain type

Although in fact only three of the seven contributions concern finite elements, the volume gives an excellent overview, including many useful references, of recent work in Japan on the numerical solution of evolution equations.

V. T.

8[2.05].—L. COLLATZ,G. MEINARDUS & H. WERNER (Editors), *Numerical Methods of Approximation Theory*, International Series of Numerical Mathematics 52, Birkhäuser-Verlag, Boston, Mass., 1980, 337 pp., 24 cm. Price $29.00.

This volume contains papers presented at a conference organized by the editors. This conference took place at the Mathematical Research Institute, Oberwolfach, Germany, from March 18–24, 1979.

9[6.15].—J. ALBREACHT & L. COLLATZ (Editors), *Numerical Treatment of Integral Equations*, International Series of Numerical Mathematics 53, Birkhäuser-Verlag, Boston, Mass., 1980, 275 pp., 24 cm. Price $33.00.

This volume contains papers presented at a workshop organized by the editors. The workshop took place at the Mathematical Research Institute, Oberwolfach, Germany, from November 18–24, 1979.

10[4.15, 5.00].—H. D. MITTELMANN & H. WEBER (Editors), *Bifurcation Problems and Their Numerical Solution*, International Series of Numerical Mathematics 54, Birkhäuser-Verlag, Boston, Mass., 1980, vii + 243 pp., 24 cm. Price $24.00.

This volume contains papers presented at a workshop organized by the editors. The workshop took place at the University of Dortmund, Germany, from January 15–17, 1980.

11[4.00, 500].—MICHAEL G. CRANDALL (Editor), *Nonlinear Evolution Equations*, Academic Press, New York, 1978, ix + 255 pp., $23\frac{1}{2}$ cm. Price $13.00.

This is the proceedings of a symposium conducted by the Mathematics Research Center of the University of Wisconsin on October 17–29, 1977. It contains 13 papers on the subject of the conference title.

12[2.00].—CARL DE BOOR & GENE H. GOLUB (Editors), *Recent Advances in Numerical Analysis*, Academic Press, New York, 1978, ix + 270 pp., $23\frac{1}{2}$ cm. Price $17.00.

This is the proceedings of a symposium held on May 22–24, 1978 at the Mathematics Research Center of the University of Wisconsin. It contains 12 papers on topics of current interest in numerical analysis.

13[4.00].—I. GLADWELL & D. K. SAYERS (Editors), *Computational Techniques for Ordinary Differential Equations*, Academic Press, London, 1980, 304 pp., $23\frac{1}{2}$ cm. Price $23.00.

This volume contains 11 papers based on lectures given at the conference on Computational Techniques for Ordinary Differential Equations held at the University of Manchester on December 18–20, 1978.

14[13.15, 5.00].—J. T. ODEN (Editor), *Computational Methods in Nonlinear Mechanics*, North-Holland, New York, 1980, viii + 539 pp., 23 cm. Price $68.50.

This volume contains 26 papers selected from the invited and contributed lectures presented at the Second International Conference on Computational Methods in Nonlinear Mechanics, held March 26–29, 1979 in Austin, Texas.

15[2.00].—L. C. W. DIXON, E. SPEDICATO & G. P. SZEGÖ (Editors), *Nonlinear Optimization Theory and Algorithms*, Birkhäuser-Verlag, Boston, Mass., 1980, vi + 486 pp., 23 cm. Price $29.80.

This volume contains lecture notes of 18 lectures given at a Summer School held at the University of Bergamo, Italy, in September 1979.

16[5.00].—J. G. VERWER (Editor), *Colloquium Numerical Solution of Partial Differential Equations*, MC Syllabus 44, Mathematisch Centrum, Amsterdam, 1980, iv + 194 pp., 24 cm. Price Dfl. 24,— —.

This volume contains 12 lectures presented at a colloquium on the Numerical Solution of Partial Differential Equations held in 1980. They were given at six monthly meetings held in Delft, Nijmegen and Amsterdam.