working code, you have to give hints about how to write it. In this case the hints have expanded to fill three of the four substantive chapters of the book.

The scientific community has been well served by the tradition that spawned the Handbook, EISPACK, LINPACK, and LAPACK. Because of the exhaustive documentation of the first three packages—LAPACK provides only documentation on usage, not on algorithmic and implementation details—they have been studied and modified by people who want to learn and customize. They are in fact the true templates of numerical linear algebra, and it would be a shame if the best and brightest were to desert the tradition. As I said earlier, the authors have produced a very useful book that is worthy of wide distribution. But the reader should keep in mind that the best template is carefully crafted, thoroughly documented working code.

G. W. S.

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27[40A15, 30B70, 42C05, 33B15, 30E05].—S. Clement Cooper & W. J. Thron (Editors), *Continued Fractions and Orthogonal Functions: Theory and Applications*, Lecture Notes in Pure and Appl. Math., vol. 154, Dekker, New York, 1994, xiv + 379 pp., 25 cm. Price: Softcover $145.00.

The birth and early development of the general theory of orthogonal polynomials are found in the investigations of continued fractions by Stieltjes and Chebyshev. As the offspring grew, it soon went its separate way, developed an independent identity and all but forgot its roots. Recent years have seen a reconciliation of sorts as workers in orthogonal polynomials have rediscovered continued fractions and what they can do for the study of orthogonal polynomials and simultaneously, researchers in continued fractions have found new applications and generalizations involving orthogonal functions. Much of the credit for this renewal goes to the Colorado school of continued fractions and its Norwegian connection. The volume under review, containing the proceedings of a seminar-workshop held in Leon, Norway, reflects this fact, since the participants heavily represent the original members of this group and several generations of their students.

The longest of the sixteen papers in this volume, "Orthogonal Laurent polynomials on the real line," by Lyle Cochran and S. Clement Cooper, presents a comprehensive, self-contained survey of the title topic, which was first introduced by Jones, Thron and Waadeland in 1980. This summary should prove to be a useful introduction to this significant generalization of the classical moment problems and orthogonal polynomials. By contrast, a second fairly extensive survey, "Continued fraction representations for functions related to the Gamma function," by L. J. Lange, gives a number of continued fraction representations for a large variety of specialized complex functions which are related to the classical gamma function. Between these two expositions of generalization and specialization, the remaining papers included here present new results covering convergence questions and truncation error bounds for continued fractions and sequences of linear fractional transformations, applications to moment problems, orthogonal functions on the real line and the unit circle, Szegö and related polynomials, their zeros and applications to frequency analysis. In addition, the preface contains an interesting historical survey of the Colorado-Norway group which began with Wolf Thron and his early association with the late Arne Magnus.

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28[68-01, 68Q40].—Richard Zippel, *Effective Polynomial Computation*, Kluwer, Boston, 1993, xii + 363 pp., 24 cm. Price $87.50.

The field of computer algebra has gained widespread attention in recent years with the increased popularity and use of computer algebra systems such as Derive, Maple and Mathematica (and others) in the general scientific community. These systems have an extensive set of mathematical capabilities in such diverse areas as basic algebra (e.g., polynomial operations such as factorization and GCD computation) and analysis (e.g., determining closed-form solutions of integrals and differential equations). For mathematicians using these systems there is often a natural desire to learn more about the algorithms that are used in these systems. Unfortunately, there are very few suitable textbooks or survey articles that introduce mathematicians to these algorithms. Since the alternative is to search through a wide variety of research papers and Ph.D. theses, this makes the area a difficult one to begin research.

This text is meant as a one-semester course to introduce students and researchers to some of the fundamental algorithms used in computer algebra, in particular, for computation with polynomials. It can be used as a text for upper-year undergraduate or starting graduate students. The term "effective" used in the title could also be read as practical in the sense that the approach used is one of describing algorithms that work in practice, rather than only in theory.

The author makes the point that many of the algorithms of polynomial computation have their origins in computational number theory (e.g., Hensel lifting) and uses this as his starting point. The topics covered include continued fractions, solving Diophantine equations, and algorithms for polynomial computations such as factorization, interpolation, elimination and computation of greatest common divisors. Computational methods such as Chinese remaindering and Hensel lifting that are used to overcome the basic problem of intermediate expression swell are also covered. In addition to these deterministic methods the author discusses some heuristic and probabilistic techniques used in some computer algebra computations.