5[68W30, 11Yxx, 12Y05, 13Pxx]—*Fundamental problems of algorithmic algebra*, by Chee Keng Yap, Oxford University Press, New York, NY, 1999, xv+510 pp., 24 cm, hardcover $72.00

In the last few years a variety of good textbooks on computer algebra have appeared. On the introductory pages, Yap mentions fourteen such textbooks, eleven of which were published in the 1990's (a notable exception is the classic text by Borodin and Munro which dates back to 1975). This list does not (yet) mention the recent books (*Some tapas of computer algebra*, A. M. Cohen, H. Cuypers and H. Sterk (eds.), Springer, 1999; *Computational methods in commutative algebra and algebraic geometry*, W. V. Vasconcelos, Springer, 1998; *Modern computer algebra*, J. von zur Gathen and J. Gerhard, Cambridge University Press, 1999; *Polynomial algorithms in computer algebra*, F. Winkler, Springer, 1996; and *Computational commutative algebra I*, M. Kreuzer and L. Robbiano, Springer, 2001).

The title of Yap's book does not mention the words computer algebra, but in his preface he writes "The preferred name today is 'computer algebra' although I feel that 'algorithmic algebra' better emphasizes the true nature of the subject." Like most of the books referred to above, Yap's treatment stays away from too close a connection with a specific package by dealing with the algorithms on an abstract mathematical level. Algorithms are stated in natural words using mathematical concepts or in pseudocode, and their correctness and/or complexity is established in the usual definition, lemma, proposition, theorem format. By the way, the latter three kinds of statement together with proofs appear in heavily bordered boxes. This layout sets the tone for the book: it is an almost self-contained treatment of the most basic topics in computer algebra, well presented, and with good attention to complexity issues. The reader is supposed to know some abstract algebra, but little else.

The book starts out with a treatment of the notions of effective computation, complexity and (as an example) the fundamental theorem of algebra (the fact that every univariate polynomial over the complex numbers has a root). It then deals with multiplication, factorization, (sub)resultants and modular techniques for gcd and the like. After four initial chapters on these topics, the author returns to the fundamental theorem of algebra and deals with constructive field theory and roots finding of a univariate polynomial equations. Next, Sturm theory, the algebraic treatment of real roots (their signs and order of occurrence) appears, followed by two chapters on lattice reduction algorithms. The book treats matrices marginally, but devotes a chapter to linear systems, with emphasis on Hermite and Smith normal form. Then come three chapters on solving multivariate polynomial systems of equations. Here the author devotes a little more than average attention to the complexity issues. Perhaps remarkable is the last chapter (14), which deals with continued fractions applied to approximating real roots of polynomials and to interval arithmetic.

I think Yap has succeeded in bringing about a pleasant introduction to the main algorithms of computer algebra. It distinguishes itself from most others in that it is a real textbook (that is, good to use in class), introduces almost all basic topics in a palatable way, and gives a serious treatment of complexity. How useful is it compared with the many other (good) new treatises? I suppose the future will tell.

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