This volume contains chapters on sets, mappings, binary relations and graphs, transitivity and connectivity, and special graphs. The second volume is to deal mostly with graph theory, and to include one chapter on network flows and another on search algorithms. As might be expected, the emphasis throughout the text is on the explanation of basic concepts through repeated illustrations, rather than on proofs of theorems. (The "modern algebra" of the title is a misnomer.) The books should prove an excellent introduction to applied graph theory for a non-mathematician.

W. G. BROWN,
McGILL UNIVERSITY

Lectures on numerical methods, by I. P. Mysovskih. 344 pages. Translated by L. B. Rall. Noordhoff, Groningen, 1969. U.S. $12.50.

In this book the course of lectures on numerical methods (part I) given by the author to students of the mathematics-mechanics department of Leningrad State University is set down. As stated in the preface, "only topics which, in the opinion of the author, are of the greatest value for numerical methods are considered in this book".

The book contains four chapters. Ch. I deals with the numerical solution of non-linear equations. A large part of the chapter is used to discuss the general method of iteration (both for a single equation and for systems), the method of Newton (a number of convergence theorems for the case of a single equation are given), and the method of Lobačevskii (Graeffe's root-squaring method). Methods for solving systems of linear equations are not considered in the book.

Ch. II is on algebraic interpolation and consists of the standard topics: calculus of finite differences, divided differences, Lagrange interpolation, formulas of Newton, Gauss, Stirling, and Bessel. Hermite interpolation is treated in greater detail than it is usually done in similar books. A brief section on numerical differentiation concludes the chapter (extrapolation to the limit is not mentioned).

The approximate calculation of integrals is discussed in Ch. III. Here a section on Markov's quadrature formulas is, in the opinion of the reviewer, particularly valuable. The other sections present material on Newton–Cotes and Gaussian quadrature, Bernoulli numbers and polynomials, and the Euler–Maclaurin formula. Remarks regarding the selection of a particular quadrature formula are added in a final section.

In the last chapter the numerical solution of the Cauchy problem for ordinary differential equations is studied. Again the reader finds most of the classical topics: the methods of Runge–Kutta, finite-difference methods in general, the methods of Adams type, and the methods of Cowell and Störmer for second-order equations. For the methods of Adams type a very detailed error analysis is given in the last

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section. On the other hand, the concept of stability is mentioned only very briefly at the very end of the chapter.

Each chapter contains a collection of instructive exercises (no hints for the solution are given).

This is a very well written book, and the translation is of excellent quality. The only (but significant) negative feature of the book is the lack of an index.

H. Brunner,
Dalhousie University

Studies in number theory, by W. J. LeVeque (editor). vii+212 pages. M.A.A. Studies in Mathematics, Vol. 6, 1969.

The intent of this book is to illustrate the remarkable breadth of the theory of numbers and of the array of other mathematical theories that have been successfully applied to number theoretic questions. The articles can all be read without extensive prior knowledge of number theory. If the reader wishes to delve deeper into any topic discussed in the book, a lengthy list of references is provided.

The articles are: (1) "A brief survey of Diophantine equations" by W. J. LeVeque, (2) "Diophantine equations: p-adic methods" by D. J. Lewis, (3) "Diophantine decision problems" by J. Robinson, (4) "Computer technology applied to the theory of numbers" by D. H. Lehmer, and (5) "Asymptotic distribution of Beurling's generalized prime numbers" by P. T. Bateman and H. G. Diamond.

Suppose $p=4k+1$ is a prime. Then there exists an a and b such that

$$p = a^2+b^2.$$

On pages 134–135, D. H. Lehmer gives a procedure for determining a and b based on an idea of Hermite. The following unpublished procedure was orally communicated to the reviewer by John Brillhart:

(i) Solve $u^2 \equiv -1 \pmod p$, $0<u<p/2$, by first finding a quadratic nonresidue of p (by the Quadratic Reciprocity Law) and then calculating

$$u \equiv n^{(p-1)/4} \pmod p.$$

(ii) Carry out the Euclidean algorithm on p and u to the point where the remainders $r_1, r_2, \ldots, r_{m-1}, r_m, r_{m+1}$ are such that

$$r_{m-1}^2 > p > r_m^2.$$

Then

$$p = r_m^2+r_{m+1}^2.$$

This book will provide excellent reading to both the professional and amateur number theorist.

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