11[X].—Robert G. Busacker & Thomas L. Saaty, *Finite Graphs and Networks, An Introduction with Applications*, McGraw-Hill Book Co., New York, 1965, xiv + 294 pp., 24 cm. Price $11.50.

In contrast to most other authors of recent books in graph theory, these writers have done little original research in the field, and this may have affected their generally excellent choice of material for an introductory book. The work is in two parts: basic theory and applications. The first deals with most of the standard topics and ideas (an exception being the four pages devoted to hypo-hamiltonian graphs). The second part has two chapters, one of which is on network flows. The other, entitled "A Variety of Interesting Applications," is over one hundred pages in length and includes sections on applications to economics and operations research, puzzles and games, engineering, and the physical and human sciences. This collection is unique, and many of the sections were written with the assistance of appropriate specialists.

The material is generally well referenced, but there are exceptions. The proof of Kuratowski's theorem characterizing nonplanar graphs is called "a refinement due to Berge." This error is partly the fault of Berge, who uses an uncorrected proof by Dirac and Shuster, and that proof is also given here. Another example of poor referencing is that for the result on the nonbiplanar character of the complete 9-point graph. There are at least two proofs in English and in more accessible journals than the article in French cited.

Graph theory is notorious for its proliferation of terminology, and this book has a selection which could (excepting such terms as *inarticulate* graphs) be adopted for general usage. There is a good selection of exercises of varying difficulty, and answers and hints are provided. Summarizing, the book is a very good one for anyone interested in learning some basic graph theory.

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12[X].—G. N. Polozhii, *The Method of Summary Representation for Numerical Solution of Problems of Mathematical Physics*, translated from the Russian by G. J. Tee, Pergamon Press, New York, 1965, xx + 283 pp., 23 cm. Price $10.00.

In this book a method is given for the numerical solution of a class of boundary and initial value problems for second and fourth order linear partial differential equations. The method rests on the transformation of the finite difference approximation to the differential equation into a vector difference equation in one variable, and the explicit solution of the latter. This explicit solution contains open constants determined by the initial or boundary conditions.

Let the finite difference approximation be

$$R\bar{u}(x) + T\bar{u}(x) = f(x), \tag{1}$$

where (a) $\bar{u}(x) = (u_1(x), \cdots, u_n(x))$, $u_k(x) = u(x, y + kh_1)$, $k = 0, 1, \cdots$, and $h_1 > 0$; (b) $R\bar{u}(x) = \sum_{i=1}^{m} a_i[\bar{u}(x + ih) + \bar{u}(x - ih)]$, with $m$ some (small) positive integer, $a_i$ particular constants, and $h > 0$; (c) $T$ is a tridiagonal matrix of the form $T = PLP$, with $L$ diagonal and $P^2 = I$, for $I$ the identity matrix; (d)

$f$ is some vector function. Defining $U = P\bar{u}$, and $F = Pf$, Eq. 1 becomes

$$RU(x) + LU(x) = F, \tag{2}$$

which is a system of difference equations in $U$ as a function of $x$; Eq. 2 is then solved explicitly.

The method is most effective when applied to the basic differential equations of mathematical physics for rectangular regions with many mesh points, for it does not require excessive computation and so prevents the accumulation of computational errors. For more general equations and regions it becomes difficult to use this method, for solutions to Eq. 2 cannot then be easily obtained.

The author stresses the fact that the development of new and more efficient mathematical methods is fully as important as the development of faster computing machines; his method represents a useful and interesting step in this direction.

The book is divided into two chapters and one appendix. In Chapter 1, explicit solutions are obtained for various difference equations in one variable, corresponding to Eq. 2; in Chapter 2 problems associated with Laplace's equation, the wave and heat equations and others are examined, using the author's method. In the Appendix, additional examples and some extensions of the theory are given.

The presentation of the material is at times hard to follow, and no clear explanation of the author's method is given at any point. There are some slight misprints, and two references (Nos. 16, 71) are missing. Nevertheless, the book is of definite value and interest.

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**13[X].**—James F. Price, *Numerical Analysis and Related Literature for Scientific Computer Users*, 2nd ed., Math. Note No. 456, Mathematics Research Laboratory, Boeing Scientific Research Laboratories, Seattle, Washington, March 1966, viii + 191 pp., 28 cm.

The explosive growth of publications in the field of numerical analysis is reflected in the relative size of the second edition of this annotated bibliography. Thus, we now find listed the contents of 151 books in English, whereas the first edition, dated May 1961, listed 69 book titles. Furthermore, the author states in the Preface that the present list is not quite as complete as the original one, and several books previously reviewed have now been dropped.

It is stated in the Introduction that this document was prepared to assist the large number of computer programmers who are not specialists in numerical analysis.

The body of this document consists of three main subdivisions. The first, entitled Numerical Procedures in Books, lists alphabetically by author the great majority of the texts in English on numerical analysis, as well as a very limited selection of related books. Those references considered by the present author to be especially helpful for computer users are designated by a double asterisk. For each book listed a brief summary is provided, indicating the level of difficulty, and the table of contents is reproduced.