Table II contains 20S values of the nodes $t_{j,n}$ and weights $w_{j,n}$ of the Gaussian quadrature rules $2\pi^{-1/2} \int_0^\infty \exp(-x^2)f(x)dx \doteq \sum_{j=1}^n w_{j,n}f(t_{j,n})$, $n = 1(1)20$. The recurrence coefficients were computed in 50S arithmetic from the moments of $\exp(-x^2)$ by means of the quotient-difference algorithm. The Gaussian nodes and weights were calculated in 30S arithmetic, using methods of Golub and Welsch (Gene H. Golub and John H. Welsch, "Calculation of Gauss quadrature rules," *Math. Comp.*, v. 23, 1969, pp. 221–230).

W. G.

**43[2.20, 2.45, 5, 9, 11, 12, 13.20, 13.35, 13.50].**—J. T. Schwartz, Editor, *Mathematical Aspects of Computer Science*, Vol. 19, Proc. Sympos. Appl. Math., Amer. Math. Soc., Providence, R. I., 1967, v + 224 pp. Price \$6.80.

This volume contains research and expository papers on computer science and its mathematical facets. The eleven contributions will now be briefly treated in turn.

"A review of automatic theorem proving": J. A. Robinson surveys the methods and results and observes that under very general conditions a theorem-proving problem can be solved automatically if it can be solved at all. This expository paper, which is of particular interest to logicians and computer scientists, records that some theorem-proving problems considered unfeasible five years ago, can now be treated on a computer with relative ease although other problems involving set-theoretic notions have computationally inefficient solutions.

"Assigning meanings to programs": Robert W. Floyd offers a basis for formal definitions of the meanings of computer programs by defining programming languages in a way so that a rigorous standard is established for proofs about computer programs, including proofs of corrections, equivalence, and termination. This research paper is of interest principally to computer scientists who have followed the work of J. McCarthy, A. Perlis, and S. Gorn.

"Correctness of a compiler for arithmetic expressions": John McCarthy and James Painter give a proof of the correctness of a simple algorithm for compiling arithmetic expressions into machine language. Their ultimate goal is to make it possible to use a computer to check proofs that compilers are correct. This research paper is the first one in which the correctness of a compiler is proved.

"Context-free languages and Turing machine computations": J. Hartmanis derives a result that establishes a close tie between complements or intersections of context-free languages and Turing machine computations. In addition he gives some new results about the complements, intersections, and quotients of context-free languages. This expository and research paper is of interest mainly to computer scientists active in automata theory.

"Computer analysis of natural languages": Susumu Kuno surveys a portion of the field of computational linguistics. In fact, his survey is confined only to algebraic (i.e., nonstatistical) studies concerning the syntax and semantics of natural languages. The reviewer agrees with the author that such studies are more prevalent, but regards his statement that they are also more interesting as being a matter of personal taste. Most of this thorough expository paper is devoted to a detailed analysis of parsing algorithms for generative and transformational grammars of N. Chomsky.

"The use of computers in the theory of numbers": P. Swinnerton-Dyer presents a brief treatment of a topic in number theory in which the theory appears to be incomplete (i.e., there are yet undiscovered relations between the existing concepts) and in which a computer can be used to accumulate facts in the hope that a pattern will emerge. The particular problem is to find rational solutions of inhomogeneous cubic equations with rational coefficients and to study the set of its rational solutions.

"A machine calculation of a spectral sequence": M. E. Mahowald and M. D. MacLaren study Stiefel manifolds with a view to uncovering some internal structure by means of machine computation. After a brief description of the topology of the problem they discuss some of the details of the computations, which were performed on a CDC 3600.

"Numerical hydrodynamics of the atmosphere": C. E. Leith describes a numerical model for the long-term prediction of weather. The partial differential operators of the continuous model are approximated by finite-difference equations, which reduce the integration of the evolution equations to a numerical process. However, no computer calculations are presented.

"The calculation of zeros of polynomials and analytic functions": J. F. Traub studies a class of new methods for the calculation of zeros. Continuing his earlier work, he gives a simplified treatment of the case of a polynomial with distinct zeros and one zero of largest modulus. In other sections he treats the case of a zero of smallest modulus, the calculation of multiple zeros and equimodular dominant zeros of polynomials, and zeros of analytic functions. This research paper is of particular interest to numerical analysts.

"Mathematical theory of automata": Michael O. Rabin surveys the major developments and trends in the theory of finite automata. The treatment is very complete since it covers the theories of nonprobabilistic finite-automata, probabilistic finite-automata, and finite tree-automata, whose foundations were largely established by the author. He appends a list of interesting problems for further research.

"Linearly unrecognizable patterns": Marvin Minsky and Seymour Papert study the classification of certain geometrical properties according to the type of computation necessary to determine whether a given figure has them. This lengthy research paper treats local vs. global geometric properties, series vs. parallel computation, and the theory of perceptrons.

In summary, this volume has bits of knowledge from many different branches of mathematics, with the computer or computation being the common thread. All authors are recognized in their field and their lists of references are generally excellent. Only a few minor typographical errors were noted, which the reader can easily detect and correct.

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**44[4, 5, 6].**—Francis B. Hildebrand, *Finite-Difference Equations and Simulations*, Prentice-Hall, Inc., Englewood Cliffs, N. J., 1968, ix + 338 pp., 23 cm. Price $12.75.