52[9].—EDGAR KARST, *The First 2500 Reciprocals and their Partial Sums of all Twin Primes* (p, $p + 2$) *between* (*3*, *5*) *and* (*102761*, *102763*), Department of Mathematics, University of Arizona, Tucson, Arizona, January 1969. Ms. of 271 computer sheets deposited in the UMT file.

Herein are tabulated to 20D the reciprocals of the first 2500 twin primes, together with the cumulative sums, calculated on an IBM 1130 system. This table is preceded by a listing of the computer program employed in its construction. An appended table of two pages lists the first member of each of the prime pairs considered.

In his introductory remarks the author notes the accuracy of the counts of twin primes published by Glaisher [1] and by Hardy & Littlewood [2] and confirms the errors in Sutton [3] as announced by Sexton [4]. However, he fails to refer to extensive counts of twin primes by Lehmer [5] and by Gruenberger & Armerding [6].

The author also remarks upon the slow convergence of the series of the reciprocals of the twin primes; for example, his table reveals that the sum of the reciprocals of the first 2500 such primes is 1.6733 . . . , whereas Fröberg [7] has calculated the sum to 4D of all such reciprocals to be 1.7019 (herein referred to as Brun's constant).

Regrettably, the appearance of these tables is marred by the occasional suppression of zeros in the computer-printed output.

<div align="right">J. W. W.</div>

1. J. W. L. GLAISHER, "An enumeration of prime-pairs," *Messenger of Math.*, v. 8, 1878, pp. 28–33.

2. G. H. HARDY & J. E. LITTLEWOOD, "Partitio numerorum III: On the expression of a number as a sum of primes," *Acta Math.*, v. 44, 1923, pp. 1–70.

3. C. S. SUTTON, "An investigation of the average distribution of twin prime numbers," *J. Math. and Phys.*, v. 16, 1937, pp. 1–42.

4. C. R. SEXTON, "Counts of twin primes less than 100000," *MTAC*, v. 8, 1954, pp. 47–49, Note 158.

5. D. H. LEHMER, "Tables concerning the distribution of primes up to 37 millions," 1957, ms. deposited in UMT file. (See *MTAC*, v. 13, 1959, pp. 56–57, RMT 3.)

6. F. GRUENBERGER & G. ARMERDING, *Statistics on the First Six Million Prime Numbers*, Rand Corporation, Santa Monica, California, 1961. (See *Math. Comp.*, v. 19, 1965, pp. 503–505, RMT 73.)

7. CARL-ERIK FRÖBERG, "On the sum of inverses of primes and of twin primes," *Nordisk Mat. Tidskr. Informations-Behandling*, v. 1, 1961, pp. 15–20.

53[10, 13.35].—MICHAEL A. ARBIB, Editor, *Algebraic Theory of Machines, Languages, and Semigroups*, Academic Press, New York, 1968, xvi + 359 pp., 23 cm. Price $16.00.

This book is a collection of papers or chapters in the general areas of finite state machines, context-free languages, and finite semigroups. Some of the contributions are appropriately called "chapters" as they are written in a consistent notation and provide a basis for later contributions. Other contributions are accurately described as "papers" as they are written in their own notation and are independent of the other contributions.

A major portion of this book is devoted to topics relating to the Krohn-Rhodes decomposition theorem for finite semigroups and machines. This portion includes three chapters on finite semigroups supplying needed background for two algebraic proofs of the decomposition theorem and applications to semigroup complexity. Although self-contained, these chapters are heavy on notation and will be difficult

reading for people without a strong mathematical orientation. This main development is supplemented by a number of self-contained and more expository papers which approach the semigroups from a variety of more machine-oriented points of view. This includes Zeiger's independent proof of the decomposition theorem.

The final two papers show two approaches to context-free and other languages: a grammatical approach and a power series approach.

The somewhat specialized subject matter of the book and its diversity of notation, level, and style make it an unlikely choice as a textbook, but it could prove valuable as a reference book and most people with interest in automata theory are likely to find some of the material of interest. Its strongest virtue is in its diversity of approaches and viewpoint.

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54[12].—D. W. BARRON, *Recursive Techniques in Programming*, American Elsevier Publishing Co., Inc., New York, 1968, 64 pp., 22 cm. Price $5.25.

This monograph deals with the use of recursive techniques in programming. It considers very briefly and sketchily the ideas of recursion, the mechanisms for implementation and the formal relationship between recursion and iteration. It also contains some examples and applications. It is the sort of material that should be covered in a lecture or so in an introductory course in computer science.

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55[12].—PETER WEGNER, *Programming Languages, Information Structures and Machine Organization*, McGraw-Hill Book Co., New York, 1968, xx + 401 pp., 23 cm. Price $10.95.

This book is very much a mixed bag. On the one hand, it is a useful collection of information on many of the most modish topics in computer science today; on the other hand, it suffers from a general lack of organization, occasional narrowness of viewpoint, and sometimes obscure explanations. The author states in his introduction that he plans ". . . to classify programming techniques and to develop a framework for the characterization of programming languages, programs, and computations. In the present text such a framework is developed, starting from the notions that a program with its data constitutes an *information structure*, and that a computation results in a sequence of information structures generated from an *initial representation* by the execution of a sequence of *instructions*." In fact, it appears that these notions are too abstract to be applied in any meaningful way to the subject matter of this book.

The first chapter of the book is on machine language and machine organization. The author treats the instruction set of the IBM 7094 as a paradigm for computer