$\tau(p)/p = 1883882662835292$, which ratio is not itself divisible by p. The ratio $\tau(p) \pmod p)/p$ appears to be distributed uniformly between 0 and 1. That implies that the number of such "Newman primes" (i.e., 2, 3, 5, 7, 2411, . . .) that do not exceed N should be asymptotic to $\sum_{p \leq N}(1/p) \sim \ln \ln N$. Since the normal order of magnitude of $\tau(p)$ is $\pm p^{11/2}$, and since there are no other Newman primes $\leqq$ 16067, it is therefore very improbable that $\tau(n)$, which is multiplicative, will have a zero.

D. S.

10 [9].—SAMUEL YATES, *Prime Period Lengths*, RCA Defense Electronic Products, Moorestown, New Jersey. Ms. (undated) of 525 pp. deposited in the UMT file.

This voluminous unpublished table gives the length of the decimal period of the reciprocal of each of the 105000 odd primes (excluding 5) from 3 to 1370471, inclusive. This compilation evolved over the past four years from calculations performed on a succession of electronic computers such as IBM 7090, XDS Sigma 7, RCA Spectra 70/45, and (mainly) RCA Spectra 70/55 at the Moorestown computer facility.

The author has supplied supplementary detailed information relating to the density of those tabulated primes having 10 as a primitive root, from which we find, for example, that there are precisely 39447 such primes in the tabular range. On the other hand, Artin's conjecture [1] predicts a count of 39266 in the same range; however, there exists heuristic reasoning [2] to support the observation that the density of such primes generally exceeds the predicted density. (This reviewer has found the first exception to occur for the interval ending with the prime 138289.) It may be noted here that Cunningham [3] erroneously gave 3618, instead of 3617, as the count of such primes less than 10^5. Also, D. H. Lehmer & Emma Lehmer [4] reported a count of 8245 such primes below $2.5 \cdot 10^5$, attributed to Miller, but the latter in an unpublished table [5] has given this count as 8255, in agreement with one based on the present table.

The range of this new table is more than tenfold that of any of the previous tables of this type, as listed by Lehmer [6]. The table has materially assisted its author in his continuing search for new prime factors of integers of the form $10^n - 1$ [7].

J. W. W.

1. A. E. WESTERN & J. C. P. MILLER, *Tables of Indices and Primitive Roots*, Royal Society Mathematical Tables, v. 9, Cambridge Univ. Press, London, 1968, p. xli.
2. DANIEL SHANKS, *Solved and Unsolved Problems in Number Theory*, Spartan Books, Washington, D.C., 1962, pp. 80–83.
3. A. CUNNINGHAM, "On the number of primes of the same residuacity," *Proc. London Math. Soc.*, (2), v. 13, 1914, pp. 258–272.
4. D. H. LEHMER & EMMA LEHMER, "Heuristics, anyone?," *Studies in Mathematical Analysis and Related Topics*, Stanford Univ. Press, Stanford, Calif., 1962, pp. 202–210.
5. J. C. P. MILLER, *Primitive Root Counts*, University Mathematical Laboratory, Cambridge, England. Ms. deposited in UMT file; *Math. Comp.*, v. 26, 1972, p. 1024, RMT **54**.
6. D. H. LEHMER, *Guide to Tables in the Theory of Numbers*, National Research Council Bulletin No. 105, Washington, D.C., 1941, p. 15.
7. SAMUEL YATES, *Partial List of Primes with Decimal Periods Less than 3000*, Moorestown, New Jersey, Ms. deposited in UMT file; *Math. Comp.*, v. 26, 1972, p. 1024, RMT **55**.

11 [10].—P. A. MORRIS, *Self-Complementary Graphs and Digraphs*, 24 pp. deposited in the UMT file.

Two graphs, G and $\bar{G}$, on the same set of nodes, are *complementary* if two nodes are joined in G if, and only if, they are not joined in $\bar{G}$. Two digraphs D and $\bar{D}$, on the same set of nodes are complementary if two nodes i and j are joined in D by a directed edge from i to j if, and only if, they are not joined in $\bar{D}$ by a directed edge from i to j. A graph or digraph which is isomorphic to its complement is said to be *self-complementary*.

Table A shows the 10 self-complementary graphs on 8 nodes, Table B the 36 self-complementary graphs on 9 nodes, and Table C the 10 self-complementary digraphs on 4 nodes. An accompanying text describes the method used.

AUTHOR'S SUMMARY

12 [12].—BORIS BEIZER, *The Architecture and Engineering of Digital Computer Complexes*, Vols. I and II, Plenum Press, New York, 1971, li + 394 pp. (Vol. I), xix + 847 pp. (Vol. II), 24 cm. Price $22.50 each volume.

This two-volume opus is a comprehensive discussion of the varied and interrelated problems that face the designer of a large computer complex. It is impressive in its scope and in the organization of its material, covering topics ranging from the mathematics of flowchart analysis and a dissection of machine instruction types to personnel management and the difficulties of handling thick cables under a computer room floor.

The first volume is mainly concerned with the components of a computer complex. Chapter 2 provides an excellent discussion of instruction repertoires, including various approaches to addressing, indexing, and instruction modification, and a classification of the types of instructions that appear in computers. Chapter 3 discusses the structural elements of a computer complex: memories, interrupt handling, controllers, and peripheral devices. There are two chapters on programming. Chapter 4 examines the programming process, considers certain selected techniques of general applicability, and shows how tradeoffs can be applied in this area. Chapter 5 is concerned with firmware, that is, the supporting programs that are required in order to make application programs work: assemblers, loaders, compilers, and utilities. Chapter 6 is on analysis, and is followed up in the second volume. It begins with an elementary discussion of statistics, and then shows how statistical techniques can be applied to estimating the behavior of programs, in terms both of time and of space. Transformation of flowcharts are shown to be a useful analytic tool, and the behavior of various statistical measures under these transformations is developed.

The second volume deals with questions of system organization. Chapter 8 considers the partitioning of tasks among hardware and software resources, as well as some of the interconnection problems. This chapter introduces a great deal of terminology, some of which, unfortunately, is rather obscure. Chapter 9 considers the functions and organization of the system executive, while Chapter 10 considers the system nucleus, whose task it is to manage storage and input-output. Chapters 11 and 12 consider the problem of system viability—that is, how to keep the system alive despite hardware and software failures and overloads. Viability has three components: *performance*, the ability of the system to handle its appointed tasks under varying loads; *reliability*, the mean time between failures; and *maintainability*, the mean time to recover from a failure. The viability executive has the task of maintaining system viability under the assumption that any part of the system, including