

1968). This is the study of error-correcting codes. A code  $T$  is a set of  $M$  words, called codewords. Transmission may introduce errors into  $e$  letters of a codeword  $w$  so that the received codeword  $w'$  differs in  $e$  positions from  $w$ . If by searching through the  $M$  words of the code  $T$  every codeword except  $w$  differs from  $w'$  in more than  $e$  positions, the receiver then may identify  $w$  as the correct word, assuming only that there are at most  $e$  errors.  $T$  is an  $e$ -error correcting code if this is true for every codeword  $w$  of  $T$ . If  $T$  corrects  $e$  errors then  $M$ , the number of codewords in  $T$ , must be small in comparison with  $q^n$ . A considerable theory is developed to determine upper limits on  $M$ . In addition an extensive probabilistic theory is developed to determine the expected correctness of decoding in terms of probable errors in transmission. But in practice the search through the entire code  $T$  is prohibitively time-consuming for the decoder. Hence a number of algebraic systems are investigated together with algorithms for decoding.

A problem converse to error-correcting is the problem of constructing coverings. A covering set  $K$  is a set of  $N$  words which approximate all  $q^n$  words in the sense that given any word  $w'$  there is a word  $w$  of  $K$  which differs from  $w'$  in at most  $e$  places. Here the problem is to minimize  $N$ . R. G. Stanton in "Covering theorems in groups" considers this problem, generalizing the paper by Taussky and Todd, who originally met the problem in connection with a copyright issue arising in football pools. Best possible solutions in certain specific cases are given in a paper by Kalbfleisch and Weiland.

Developing some sophisticated machinery, N. G. deBruijn pushes "Enumeration of tree-shaped molecules" beyond the classical formulation of Pólya.

Many of the papers deal with graphs. A graph is a set of points of which certain pairs are joined by arcs. Frank Harary reviews classifications and a variety of descriptive invariants. The famous four-color conjecture asserts that every map which can be drawn in the plane may be colored with at most four colors in such a way that no two regions with an edge in common are given the same color. W. T. Tutte treats the general problems on graphs which include this conjecture as a special case.

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## Books Received

**Advanced Calculus.** Stephen Hoffman. Prentice-Hall, Englewood Cliffs, N.J., 1970. xiv + 386 pp., illus. \$10.50.

**Advances in Enzyme Regulation.** Vol. 7. Proceedings of the Seventh Symposium on Regulation of Enzyme Activity and Synthesis in Normal and Neoplastic Tissues, Indianapolis, Indiana, September–October 1968. George Weber, Ed. Catherine E. Forrest Weber, Technical Ed. Pergamon, New York, 1969. xiv + 450 pp., illus. \$19.

**Advances in Photochemistry.** Vol. 7. J. N. Pitts, Jr., George S. Hammond, and W. Albert Noyes, Jr., Eds. Interscience (Wiley), New York, 1969. viii + 424 pp., illus. \$19.50.

**Advances in Water Pollution Research.** Proceedings of the Fourth International Conference, Prague, April 1969. S. H. Jenkins, Ed. Pergamon, New York, 1969. xii + 936 pp., illus. \$48.

**Analysis and Characterization of Coatings and Plastics.** American Chemical Society Symposium, Atlantic City, September 1968. Claude A. Lucchesi, Ed. Interscience (Wiley), New York, 1969. viii + 206 pp., illus. Paper, \$8.95.

**Applications in Psychotherapy.** Wolfgang Luthe and Johannes H. Schultz. Grune and Stratton, New York, 1969. xii + 228 pp., illus. \$11.75.

**The Astrologers and Their Creed.** An Historical Outline. Christopher McIntosh. Praeger, New York, 1969. xviii + 146 pp. + plates. \$4.95.

**Behavioral Components of Patient Care.** John V. Gorton. Macmillan, New York; Collier-Macmillan, London, 1970. xii + 244 pp. \$7.95.

**Bile Salt Metabolism.** A conference, Cincinnati, Ohio. Leon Schiff, James B. Carey, Jr., and John Dietschy, Eds. Thomas, Springfield, Ill., 1969. xiv + 306 pp., illus. \$19.50.

**Biological Implications of the Nuclear Age.** Proceedings of a symposium, Livermore, Calif., March 1969. Division of Technical Information, U.S. Atomic Energy Commission, Oak Ridge, Tenn., 1969 (available as CONF-690303 from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va.). x + 342 pp., illus. Paper, \$3. AEC Symposium Series, vol. 16.

**Calculus.** Arthur B. Simon. Macmillan, New York; Collier-Macmillan, London, 1970. xiv + 626 pp., illus. \$11.95.

**The Hypothalamus.** Webb Haymaker, Evelyn Anderson, and Walle J. H. Nauta, Eds. Thomas, Springfield, Ill., 1969. xvi + 808 pp., illus. \$45.

**Low-Frequency Waves and Irregularities in the Ionosphere.** Proceedings of the 2nd ESRIN-ESLAB Symposium, Frascati, Italy, September 1968. N. D'Angelo, Ed. Springer-Verlag, New York; Reidel, Dordrecht, Holland, 1969. xiii + 220 pp., illus. \$14.50. Astrophysics and Space Science Library, vol. 14.

**Magmatic Ore Deposits.** A symposium, Stanford, Calif., November 1966. H. D. B. Wilson and Alan M. Bateman, Eds. Economic Geology Publishing Co., c/o Alan M. Bateman, Yale University, New Haven, Conn., 1969. viii + 368 pp., illus. Paper, \$7.50. Economic Geology Monograph 4.

**Medicine in the Ghetto.** A conference,

Portsmouth, N.H., June 1969. John C. Norman and Beverly Bennett, Eds. Appleton-Century-Crofts, New York, 1969. xxviii + 340 pp. \$6.95.

**La Microélectronique.** Robert Guillien. Presses Universitaires de France, Paris, 1969. 128 pp., illus. Paper. "Que Sais-Je?," No. 1367.

**Modern Microcrystal Tests for Drugs.** The Identification of Organic Compounds by Microcrystalloscopic Chemistry. Charles C. Fulton. Wiley-Interscience, New York, 1969. xx + 476 pp., illus. \$29.95.

**Outlines of Perennial Crop Breeding in the Tropics.** F. P. Ferwerda and F. Wit, Eds. Veenman and Zonen, Wageningen, Netherlands, 1969. xvi + 512 pp., illus. Paper, N.Fl. 49.50 Landbouwhogeschool Miscellaneous Papers 4 (1969).

**Papers on Digital Signal Processing.** Alan V. Oppenheim, Ed. M.I.T. Press, Cambridge, Mass., 1969. xvi + 208 pp., illus. Paper, \$5.95.

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**Physics of Strength and Plasticity.** Ali S. Argon, Ed. M.I.T. Press, Cambridge, Mass., 1969. xxvi + 406 pp., illus. \$12.50.

**The Political Economy of Energy and National Security.** Rocky Mountain Petroleum Economics Institute, Golden, Colo., June 1969. Steve H. Hanke, Ed. Colorado School of Mines, Golden, 1969. vi + 218 pp., illus. Paper, \$5. Quarterly of the Colorado School of Mines, vol. 64, No. 4.

**The Psychology and Physiology of Stress.** With Reference to Special Studies of the Viet Nam War. Peter G. Bourne, Ed. Academic Press, New York, 1969. xxx + 242 pp., illus. \$12.

**Radiation Biology of the Fetal and Juvenile Mammal.** Proceedings of the Ninth Annual Hanford Biology Symposium, Richland, Wash., May 1969. Melvin R. Sikov and D. Dennis Mahlum, Eds. Division of Technical Information, U.S. Atomic Energy Commission, Oak Ridge, Tenn., 1969 (available as CONF-690501 from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va.). xiv + 1026 pp., illus. Paper, \$3. AEC Symposium Series, vol. 17.

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