Eötvös Competition Problems

Hungarian Problem Book I. Based on the Eötvös Competitions, 1894–1905 (120 pp.); **Hungarian Problem Book II.** Based on the Eötvös Competitions, 1906–1928 (128 pp.). József Kürschák. Revised and edited by G. Hajós, G. Neukomm, and J. Surányi. Translated from the Hungarian revised edition (1955) by Elvira Rapaport. Random House, New York; Singer, Syracuse, N.Y., 1963. Paper, $1.95 each.

These two volumes are a compilation of the problems used in the famous Hungarian Eötvös Competitions in school mathematics during the period 1894 to 1928; solutions of the problems, based on the revised Hungarian edition of Kürschák's original compilation, are included. Translation and publication of the volumes are part of the Monograph Project of the School Mathematics Study Group.

In the Eötvös Competition three problems are posed each year. Each examination contains at least one question from the field of algebra, including elementary number theory and combinatorial mathematics, and at least one from geometry, including trigonometry. An able American high-school senior who has had 4 years of mathematics should be able to understand the solution of every problem, yet the ingenuity required to discover the solutions for many of the problems might well tax the ability of many mature students. Most of the problems are so simply stated that they will appeal to the inquiring young mind as a fascinating puzzle.

Frequently two entirely different solutions are given for the same problem. Numerous notes, some of which are historical, are added to the solutions, but the greatest number are devoted to generalizations of the problem with a solution of the more general case. I have been told that such generalizations by the contestant count heavily in his favor in scoring his competition. In fact, it appears from the solutions given that merely solving the problem as posed might count very little. For example (1918/2): "Find three distinct natural numbers such that the sum of their reciprocals is an integer." A contestant might easily find by trial that 2, 3, and 6 satisfy the conditions, but the given solution is almost entirely concerned with proving the uniqueness of the result.

There are a few misprints and minor errors, and occasionally a geometrical figure is not completely labeled. However, in nearly all cases the intent is clear.

The number of eminent Hungarian mathematicians who were winners of the Eötvös Competition is evidence of the important role played by this competition in arousing interest in mathematics among secondary school students. The School Mathematics Study Group has performed another great service to school mathematics in the United States by making these excellent problems available. Hopefully the volumes will inspire the formation of a similar problem solving competition here.

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History of Technology

The Picture History of Inventions. From Plough to Polaris. Umberto Eco and G. B. Zorzoli. Translated from the Italian by Anthony Lawrence. Macmillan, New York, 1963. 360 pp. Illus. Until 31 December, $14.95; $17.50.

Presumably this volume is intended for the Christmas picture-book trade, but it turns out to be a surprisingly good history of technology. Within 350 pages (which include some 800 illustrations), the authors present a full and, on the whole, accurate summary of man's inventiveness throughout the ages. Their survey is much more than a dry chronicle of inventions, for they take into account the human and social relationships of technology.

Neither author is a professional historian or technologist: Umberto Eco (University of Turin) specializes in medieval esthetics, and G. B. Zorzoli (Polytechnical Institute, Milan) is a nuclear physicist. Yet they provide clear expositions of technical devices and processes, and they stress the continuity of technological principles, problems, and solutions throughout history. Sometimes they overemphasize this latter point, a tendency that leads to an unhistorical perspective in which all past developments are viewed in terms of present-day technology.

There are some omissions, the most serious being the slight treatment given to the development of machine tools. There are errors of commission too: the protracted discussion of cosmological systems does not belong in a history of inventions, and Leonardo da Vinci is given credit for having a much more direct influence on the science and technology of his time than the historical facts warrant. The arrangement of the material is sometimes confusing; for example, there is neither logical nor chronological justification for placing the chapter on electrical developments before the one on the invention of the steam engine.

To offset these minor faults, the authors give us brief but enlightening discussions of the development of automata and calculating machines, the esthetics of Gothic and modern architecture, the significance of printing and of time measurement, and the cultural impact of the cinema.

Unfortunately, the book has no scholarly apparatus; there is only an incomplete index of inventions and list of illustrations. Even more unfortunate in a book entitled a "picture history" is the fact that the reproduction of the illustrations ranges from poor to awful. Finally, the subtitle, "From Plough to Polaris," is misleading; the story begins with man's evolution before the plow, and the Polaris, which is mentioned on the title page, nowhere appears in the text! The authors have written an excellent short history of inventions; they deserved better treatment from their publishers.

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Mathematics

Calculus: Problems and Solutions. Abraham Ginzburg. Holden-Day, San Francisco, Calif., 1963. xii + 455 pp. Illus. $7.75.

One's reaction to a book of this kind will probably be conditioned by his attitude toward the role that solving typical textbook problems should play in the study of mathematics. All too often, to the student, the only goal seems to be that of getting the proper answers to the exercises at the ends of the various sections of his textbook, the exposition of the ideas involved being needed only for clues to accomplish this. This book, in which the author's stated purpose is "to increase his understanding and skill in handling

problems," runs a large risk that it will intensify such a feeling. On the other hand, books in which the exposition of the ideas reaches rather sophisticated levels, but in which the majority of the problems are either routine or unvaried (there are some) tend to invoke a "tempest in a teapot" reaction among students. Although the author does not so state, this book may have been written to supplement such texts; it appears that if used in that way the book may be worthwhile.

As its title implies, this book is almost entirely devoted to problems, either solved for the student or to be solved by him, with generous hints about solving the more difficult. The discussion (other than the explanations of the solutions), which the author tries to keep minimal, is also minimal in the information that it imparts to the reader. There is occasional use of the defensive clause "it is clear" and an offhand way of making explanations—for example, the argument about why an additive constant appears in finding an antiderivative (p. 134).

The problems are generally well chosen. There are many routine exercises, some old standbys but also a variety of novel exercises touching on all the usual topics. A haphazard check of the problems indicates they are generally well stated, a few incompletely. However, for a problems book, it may also be a good exercise to pick out these.

As a reference and as a supplement to a good expository calculus book, this is to be recommended.

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Carus Mathematical Series

Combinatorial Mathematics. Herbert John Ryser. Published for the Mathematical Association of America by Wiley, New York, 1963. xiv + 154 pp. Illus. $4.

Although combinatorial mathematics is several centuries old, it has achieved a new appeal and prominence in the past quarter century, owing partly to developments within the field and partly to its growing importance with respect to cryptography, computer programming, information theory, operations analysis, the design of experiments, and other subjects of scientific, industrial, or military significance. As the author observes, "Combinatorial mathematics cuts across the many subdivisions of mathematics, and this makes a formal definition difficult. But by and large, it is concerned with the study of the arrangement of elements into sets. . . . Two general types of problems appear. . . . In the first, the existence of the prescribed configuration is in doubt, and the study attempts to settle this issue. These we call existence problems. In the second, the existence of the configuration is known, and the study attempts to determine the number of configurations or the classification of these configurations according to type. These we call enumeration problems." (He might well have added "efficiency problems," in which the existence of the configuration is known and enumeration is unimportant, but in which the demand is for an efficient algorithm that will actually produce the desired configuration; such problems arise commonly in many applications of combinatorial mathematics.)

This polished and readable account of some fascinating aspects of the subject is devoted mainly to existence problems, including several basic, original contributions made by the author himself. A good indication of coverage is provided by the chapter headings: "Fundamentals of combinatorial mathematics" (16 pages); "The principle of inclusion and exclusion" (12); "Recurrence relations" (9); "A theorem of Ramsey" (9); "Systems of distinct representatives" (14); "Matrices of zeros and ones" (18); "Orthogonal Latin squares" (17); "Combinatorial designs" (35); "Perfect difference sets" (12).

Most of the material is "elementary" in the sense that its understanding does not require an extensive mathematical background. Nevertheless, the subject is justly known for its difficulty, and Ryser is to be congratulated for his clear presentation. The exposition is supplemented by a good index and an appropriate bibliography for each chapter. An attractive feature is the mention of various interesting unsolved problems, in which the field abounds. As the author concludes in his preface: "Combinatorial mathematics is tremendously alive at this moment, and we believe that its greatest truths are still to be revealed."

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Geochemistry

Earth Science and Meteoritics. Compiled by J. Geiss and E. D. Goldberg. North-Holland, Amsterdam; Interscience (Wiley), New York, 1963. xvi + 312 pp. Illus. $10.50.

The variety in this collection of 15 articles is an admirable tribute to the versatility, wide interests, and stimulating personality of Fritz Houtermans, professor of physics in the University of Berne. The articles cover a number of topics of great current interest and research activity, and the list of authors is a guarantee of careful and judicious treatment. The extreme variety of the topics, however, may militate against the wide circulation this book deserves, since most people, other than specialists in radiochemistry and isotope geochemistry, are likely to find their interest limited to one or a few of the articles. The book would be useful collateral reading for graduate courses in geochemistry.

The articles are "Early history of the Earth" (30 pp.), by W. M. Elsasser; "Radioactive heat production in eclogite and some ultramafic rocks" (12 pp.), by G. R. Tilton and G. W. Reed; "Some recent researches on lead isotope abundances" (29 pp.), by R. D. Russell; "The concentration of common lead in sea water" (15 pp.), by M. Tatsumoto and C. C. Patterson; "Rates of sediment accumulation in the Indian Ocean" (12 pp.), by E. D. Goldberg and M. Koide; "The natural distribution of radiocarbon: Mixing rates in the sea and residence times of carbon and water" (12 pp.), by H. Craig; "On the investigations of geophysical processes using cosmic ray produced radioactivity" (26 pp.), by D. Lal; "Neutrons in meteorites" (24 pp.), by P. Eberhardt, J. Geiss, and H. Lutz; "The tritium content of atmospheric hydrogen and atmospheric methane" (17 pp.), by F. Begemann; "Tritium in rainwater" (17 pp.), by H. v. Buttlar; "Cosmic ray produced Na^{22} and Al^{26} activities in chondrites" (11 pp.), by M. M. Biswas, C. Mayer-Böricke, and W. Gentner; "Isotopic and chemical composition of some terrestrial natural gases" (21 pp.), by G. J. Wasserburg, E. Mazor, and R. E. Zartman; "Rare gases in the sun, in the atmosphere, and in meteorites" (30 pp.), by P. Signer and H. E. Suess; "The half-life of ^{187}Re" (7 pp.), by B. Hirt, G. R. Tilton, W. Herr, and W. Hoffmeister;