equations are then used in a discussion of block replacement, replacement based on age, and random replacement. Next, optimum replacement policies subject to cost and availability constraints are analyzed, with special reference to dynamic programming procedures when these procedures are applicable. In the chapter concerned with stochastic models, the authors consider repair problems and optimal maintenance policies when the deterioration law of the system is assumed to be Markovian or semi-Markovian.

Chapter 6 is concerned with postulating models that give the amount of redundancy (both parallel and standby) necessary to maximize the probability of system survival subject to various constraints. Finally, monotonic (coherent) structures are discussed with special emphasis on k out of n structures. Bounds are given for structure reliability. Also, a generalized version of the Moore-Shannon inequality is employed to obtain the number of components needed to achieve a specified reliability.

In conclusion, it seems that this book will be a worthwhile addition to the libraries of probabilists and mathematicians working in the area of reliability analysis; however, owing to its theoretical nature and because adequate examples are not provided in some cases, it is doubtful whether the practicing reliability engineer will find it of much value.

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An Encyclopedic Survey

Structure of Matter. Wolfgang Finkelnburg. Translated from the 9th/10th German edition (1964) by the author and Ottilie Matossi-Riechemeier. Springer, Berlin; Academic Press, New York, 1964. xii + 511 pp. Illus. $14.50.

This book covers a huge range of material with a competence that is almost frightening. There are seven basic sections: Introduction; Atoms, Ions, Electrons, Atomic Nuclei, Photons; Atomic Spectra and Atomic Structure; Quantum Mechanics; Physics of Atomic Nuclei and Elementary Particles; Molecular Physics; and Solid-State Physics from the Atomistic Point of View. The last section, for example, is roughly equal in word count to some of the smaller books on the subject, such as Wannier's *Elements of Solid State Theory*.

Structure of Matter has the format of a textbook and it is, according to the preface, "written for students of physics, chemistry, biology, and engineering, in fact for all who wish to keep abreast with the rapid progress being made in this important field." The idea of a student of biology "keeping up" with the Gell-Mann theory of elementary particles, the developments in connection with controlled fusion, the shell model and collective model of the nucleus, the wave-mechanical theory of radiation, and a host of similar topics seems all too much like a dream (or a nightmare?). Accordingly, it appears to me that the major value of the book is not as a textbook, but rather as a kind of "low-brow reference book." To put it simply, there are very few (if any) subjects covered here which are not better covered somewhere else, so the value of the book is in the package deal that it offers.

The first edition of Finkelnburg's *Einführung in die Atomphysik* appeared in 1948, the present work being a translation from the 9th/10th German edition. It is amazingly up-to-date in its descriptive sections which are, by their nature, easy to update—for example, the table "Presently Known Elementary Particles" proudly lists the Ω^-. But the authoritarian spirit that allows the author, on page 335, to quote an equation without any explanation (much as $E = mc^2$ might appear in the New York *Times*) does not lend itself to exposition of matters where understanding is more important than facts. One may perhaps forgive the refusal to use the notation $\hbar$ instead of cluttering the equations with factors of 2π; that is symbolic more than symptomatic of the approach. What is less forgivable is the old-fashioned introduction of quantum mechanics as an improvement of the old Bohr-Sommerfeld theory, accompanied by fanfares about gamma-ray microscopes, thought experiments, and the uncertainty principle. The present generation of physicists knows that the essence of quantum mechanics, in the sense of superposition of probability amplitudes, is not complicated and, incidentally, has nothing to do with partial differential equations. What *is* complicated is the connection between quantum mechanics and classical mechanics. Because classical mechanics was known earlier, it is understandable that the historical development had to go through that very difficult path, but there is no reason for an introductory treatment to become deeply involved with it. Along similar lines, the section "Achievements, Limitations, and Philosophical Significance of Quantum Mechanics" is ponderous and not particularly useful. Quantum mechanics is something one does not so much *learn* as *get used to*—a fact which should not be hidden behind contrived attempts to make it look reasonable.

It remains true that some shortcomings of the sort encountered in this book are virtually inevitable when one considers the huge compass of material covered. Rather, it is impressive that such an encyclopedic work is, unlike most encyclopedias, apparently quite free of factual errors.

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Organic Analysis

Qualitative Organic Microanalysis: Cognition and Recognition of Carbon Compounds. Frank L. Schneider. Academic Press, New York; Springer, Vienna, 1964. xii + 535 pp. Illus. $22.50.

This book is a classical approach to qualitative organic analysis. Chapter 1 deals with fundamental apparatus and operations. The second chapter is devoted to preparation of the sample, including separation methods. This chapter gives an excellent description of apparatus and techniques for such microscale operations as distillation, recrystallization, and extraction. Techniques like liquid chromatography and ion exchange are included, but thin-layer chromatography and gas chromatography are not mentioned. The next three chapters are concerned with preliminary examination and include elementary analysis, determination of physical constants, and solubility.

The rest of the book is devoted to systematic analysis, much like that used by Shriner and Fuson and available in other texts. However, the inclusion of many quantitative methods for various functional groups is a distinct improvement over previous books on identification of organic compounds. Many quantitative, functional, group methods are simple to carry out, and they provide information that is

often more convincing than a mere carbon-hydrogen determination. There are several hundred references to original literature, but a preponderance of the papers cited seem to be at least 20 to 30 years old.

It seems incomprehensible that in this book no use is made of ultraviolet and infrared spectra, nuclear magnetic resonance, or gas chromatography. Most chemists consider these indispensable aids. Fifteen or 20 years ago this book might have been preeminent in its field. Although it still has some excellent features, the book is seriously deficient because it ignores most of the newer tools that are so useful in the analysis of organic compounds.

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Mathematics: Problems for Fun

Challenging Mathematical Problems with Elementary Solutions. vol. 1, *Combinatorial Analysis and Probability Theory*. A. M. Yaglom and I. M. Yaglom. Translated from the Russian edition (1954) by James McCawley, Jr. Revised and edited by Basil Gordon. Holden-Day, San Francisco, 1964. viii + 231 pp. Illus. $5.95.

The Survey of Recent East European Mathematical Literature, financed by the National Science Foundation, is adding to the growing interest in new approaches to mathematical learning. *Challenging Mathematical Problems with Elementary Solutions*, an open door to Russian pedagogy, was compiled and published in Russia by twin brothers A. M. and I. M. Yaglom. It contains some problems originally discussed in the School Mathematics Circle, designed for secondary school students, and others used in the Moscow Mathematical Olympiads. The latter is a mass problem-solving contest given annually in an effort to find young persons who are mathematically gifted.

Combinatorial analysis and probability theory are combined to produce problems that require answers to the following questions: How many? In how many ways? How often? Many of the problems in this book represent questions in higher mathematics, although no knowledge beyond that presented in a good high school is necessary for their solution. The following statement is made in the preface to the American edition: "This adaptation is designed for mathematics enthusiasts in the upper grades of high school and the early years of college, for mathematics instructors or teachers and for students in teachers' colleges, and for all lovers of the discipline."

Brief explanatory material and statements of problems greet the reader first. Answers and hints are given at the back of the book. Between the two are the "solutions" (diagrams, discussions, and complete calculations for each problem), thus enabling the self-disciplined student to teach himself. The various sections include problems related to the chessboard, the binomial coefficients, representation of integers as sums and products, combinatorial analysis, computing, probabilities, and experiments with infinitely many possible outcomes. Sets, random choice, convexity, and other notions used in the new mathematics for high schools are introduced and used. A system of asterisks is used to "grade" the problems with respect to their difficulty.

Classical examples are given: Fermat's Theorem: If p is a prime number, then $n^p - n$ is divisible by p for any n; and Cayley's problem: How many convex k-gons can be drawn, all of whose vertices are vertices of a given convex n-gon and all of whose sides are diagonals of the n-gon? Then there are modern versions of old favorites like the problem of the four liars: It is known that each of four people (A, B, C, and D) tells the truth in only one case out of three. Suppose that A makes a statement, and then D says that C says that B says that A is telling the truth. What is the probability that A was actually telling the truth? Among those attributed to 20th-century mathematicians is Banach's match box problem: A man buys two boxes of matches and puts them in his pocket. Every time he has to light a match, he selects at random one box or the other. After some time the man takes one of the boxes from his pocket, opens it, and finds that it is empty. What is the probability that there are k ($0 \leq k \leq n$) matches left in the other box, if each box originally contained n matches?

East Europeans, particularly the Poles, have found that students who are good at, and interested in, extracurricular activities of this caliber may very well develop into first-rate research mathematicians. The kernel of the process is the presentation of a problem with a limited amount of information so that an elementary solution is possible but not immediately apparent. Its solution affords the thrill of discovery and the glow of self confidence.

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Legislative Components

The Lawmakers: Recruitment and Adaptation to Legislative Life. James David Barber. Yale University Press, New Haven, Conn., 1965. xiv + 314 pp. $7.50.

The literature of political science in the United States abounds in finely honed analytical exercises. *The Lawmakers* is one of these.

The author, James David Barber, assistant professor of political science at Yale University, establishes a typology of legislators. It is based primarily, he tells us in his preface, on "twenty-seven long private interviews, tape-recorded with the subjects' consent, with legislators serving their first session in the Connecticut House of Representatives." From the 27 interviews, the author culled 12. These, in turn, furnished three examples of each of four legislative types—"spectators, advertisers, [and] reluctants and lawmakers."

The Spectator-type, according to Barber, is a small-town, middle-aged individual, often a woman, with limited skills, restricted ambitions, and modest achievements, whose easy good-nature serves to dampen tensions. Often he (or she) belongs to the minority party in localities where political survival is sought by simply filling the ballot. The legislature is "an awfully good diversion," one Spectator-type is quoted as saying.

The Advertiser qua legislator, on the other hand, is portrayed as a young person of some social and economic substance, who by much hurrying seeks to attain power and security. This self-salesman's chief stock in trade is "personality politics."

The Reluctant is akin to Winnie-the-