collection of every computer scientist. In addition, mathematicians, both pure and applied, should benefit greatly from the reading of this book, if not for the concepts involved, then certainly as a diverse exercise in mathematics for the pure enjoyment of a well-written, well-planned book.

Due to an adequate number of challenging problems, the book is certainly a worth-while textbook for an introductory senior or graduate level course in automata theory, formal languages, or other closely related subject areas. At the end of each chapter, literature references for the concepts introduced in the chapters are presented. A bibliography is provided at the end of the book.

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About the Reviewer: James B. Morris received his PhD degree, with a major in computer science, from the University of Texas at Austin in August, 1969. He is currently employed by the computer science research group at the University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico. His special interests include the design of programming language translators and the theory of alogorithm equivalence.

Information Retrieval Systems Characteristics, Testing, and Evaluation. By F. Wilfrid Lancaster. John Wiley & Sons, Inc., New York (1968). 222 pp. $9.19.

The author views his subject through the eyes of a professional librarian actively engaged in lecturing on information retrieval and in evaluating information systems. Methods of measuring, monitoring, and improving the operation of these systems complete the volume.

Persons interested in an introduction to the field will find a clear and concise presentation of the terminology and concepts in the first nine chapters. Mr. Lancaster defines his terms in a scholarly manner and illustrates the concepts introduced with easily understood examples. Chapter 1 distinguishes among document, subdocument, reference, and data retrieval; between system staff who prescribe input and system users who request output information. Chapters 2 and 3 deal with subject indexing and the more general classification process. Historical treatment of Batten's "optical coincidence" retrieval, Mooer's "Zatocoding," and Taube's "Uniterms" is provided, and application of Boolean functions, hierarchical structure, and link and role relationships is described. Organization of the index, or search, file and retrospective, demand, and current awareness (SDI) searching are covered in Chaps. 4 and 5. The two standard quantitative measures of IR system effectiveness—recall and precision ratios—are discussed in the next three chapters together with factors influencing their values, in particular *exhaustivity* of the indexing and *specificity* of the indexing language. System coverage, the amount of user effort and response time required, as well as the form in which system output is provided, are considered as measures of system performance from a user's viewpoint. Chapter 9, a survey-type presentation of the application of computing equipment to information retrieval concludes the first half.

This chapter, like several others in the latter half, suffers from the author's attempt to utilize previously published material. It appears to have been hastily updated; there are few references more recent than the original 1964 publication date.

The final seven chapters comprising the second half of the book will be of interest primarily to information scientists, and in particular, those engaged in the design or development of information retrieval systems. In these chapters the evaluation of an information system is considered. Chapters 10 through 12 cover the development of procedures for testing system performance, analysis of the test results, and application of these findings to the creation of an improved system. Economic factors are treated in Chap. 13, with a discussion of personal vs delegated search philosophies, searching strategies, and on-line interactive system considerations in Chaps. 14 and 15. In his conclusion, the author lists the principal steps involved in system design emphasizing the need to tailor individual systems to their environment and to continuously monitor their performance to achieve the optimum system. This reviewer felt a lack of cohesiveness in these chapters, introduced perhaps by the inclusion of the previously published material. The concise presentation of the earlier presentation is missing.

This is one of the volumes in the Wiley Information Science Series. As such, it represents the field from the author's viewpoint. Many of the examples are taken from Mr. Lancaster's work with the ASLIB Cranfield Project at the College of Aeronautics, Cranfield, England, and on the MEDLARS Evaluation Program at the National Library of Medicine, Bethesda, Maryland. Other selections in the series would be more appropriate for those interested in a computer-oriented look at information retrieval. The low level of exhaustivity and specificity of the index hampers the retrieval of the book's excellent definitions as a reference glossary. That's IR jargon and when you've read the book you'll know what it means!

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About the Reviewer: Margaret Butler, academically trained at Indiana University and associated with the Argonne National Laboratory since 1948, is in charge of the Argonne Code Center. Mrs. Butler's professional interests are in computer programming and design and in applied mathematics. She is a member of the Society's Publications Committee.

Induced Radioactivity. M. Barbier. North-Holland Publishing Co., Amsterdam (1969). 424 pp. $21.00.

This is an interesting and useful reference book. Discussions of the various topics begin with elementary principles so that one need not be a specialist to use it. The material is presented in a short introduction, seven chapters, and extensive appendixes. There are over 260 drawings of good quality. The introduction covers nuclear reactions, radiations, and modes of decay, and the first chapter deals with generalities such as cross sections, activation formulas, and dose rates. Subsequent chapters include, in order, activation by spallation, fission products and neutron activation, compound nucleus reactions, elec-

tron and photon bombardments, and activities induced by heavy ions. The final chapter is concerned with radioactivity induced in human tissues. The book is unique in considering so many sources of radiation. Tabular and graphical materials in the appendixes cover "k_γ factors," activity and "danger parameter" data for spallation, neutron and photonuclear activation, and a 34-page reproduction of the 1966 General Electric Chart of the Nuclides. The latter is of limited usefulness, since it has no information on branching percentages, and the half-lives of the important nuclides are given earlier with their k_γ values. The chart has thermal-neutron cross sections, however.

An unusual feature for a compendium of this type is the recommendation of proper design for new experiments to measure needed values. Further, there are 63 illustrative problems, with answers. Unfortunately, there are errors in some of these; e.g., the answer for No. 10 in Chapter I is off by 10^3, and No. 12 states the wrong half-life for ^{132}I, hence the result is incorrect.

It is disappointing that no treatment is given of "self-shadowing," reduction of the effective flux of bombarding particles by the target itself, although self-absorption of its own radiation is covered. Self-shadowing is particularly important in neutron and low-energy charged-particle bombardments. Also not covered is consumption of the target and initial products by continuing bombardment, which can be important in reactor irradiations. An inconsistency appears in the treatment of k_β for negatrons and positrons. The high level of particle dose which occurs near a negatron-emitting source is properly stressed, but it is stated that positrons are "taken care of in the k_γ-factor," which contains a term for annihilation radiation, assuming all positrons are stopped in the source. Obviously, under conditions such that negatrons could constitute a hazard, positrons would be essentially equally hazardous, and should be included in k_β, which would be substantially greater than k_γ calculated as above.

The bibliography is good, but somewhat out of date; most references are from 1966 or earlier. Notable exclusions are the 1967 *Table of Isotopes* and the journal *Nuclear Data* as sources of decay-scheme information. Use of these would have improved the photons-per-disintegration and other values cited in the appendixes. For fission yields, a modern compilation is report APED-5398-A, by M. E. Meek and B. F. Rider (General Electric, 1968). Confusing extraneous information is added to some report references and names are occasionally misspelled, but only minor inconvenience should result.

With allowance for relatively minor shortcomings, the book can be recommended for use by health physicists, reactor and accelerator engineers, radioisotope producers, activation analysts, and others concerned with dangers or uses of radiation, as well as students in those fields.

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