23 [P, X].—R. H. MACMILLAN, *Non-Linear Control Systems Analysis*, The Macmillan Company, New York, 1963, xvi + 174 p., 20 cm. Price $3.75.

This is an introductory volume for the engineer and applied mathematician who wishes to make the transition from prewar to postwar control theory. The authors cover in a very lucid fashion, with numerous examples and discussions, nonlinear control in practice, the phase-plane method, the describing function technique, the calculation of transients, and the rudiments of feedback control.

The book suffers, as do many of its kind, from a complete lack of awareness of the effect of the digital computer upon modern mathematics and control theory. There is no discussion of the use of large-scale computers, nor of dynamic programming, quasilinearization, or any other theories which depend upon modern devices for their successful utilization. There is nothing on the calculus of variations and no mention of the Pontryagin maximum principle. Furthermore, there are no references for advanced reading.

This book would have been extremely useful in 1940, or even in 1946.

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24 [X].—JOSEPH BECKER & ROBERT M. HAYES, *Information Storage and Retrieval: Tools, Elements, Theories*, John Wiley & Sons, Inc., New York, 1963, xi + 448 p., 23 cm. Price $11.95.

This is the first volume of the publisher's Information Science Series. It is written primarily from the point of view of the system designer, and is intended for use as either a textbook or a reference work. According to the preface, its purpose is to guide the newcomer through the maze of scattered development that has characterized the early growth of information storage and retrieval. The result is a well-balanced exposition of a field with tantalizing possibilities.

The first seven chapters survey the tools used by documentalists to organize recorded knowledge and make it available. Techniques developed by the library profession include classification schemes, indexes, and card catalogs. Over the years, however, both logical and physical inadequacies have appeared in the traditional approach. To cope with the logical difficulties a number of new techniques have been devised, viz., coordination of subject terms, superimposed coding of terms, generation of formalized abstracts, and analysis of subject relationships. To cope with the physical problems new recording and processing devices are being utilized, e.g., microfilm, fast reproducing equipment, and electronic computers.

In the next five chapters the authors examine how investigators with various technical backgrounds can contribute to the solution of outstanding problems. The areas of responsibility of user, operator, designer, and equipment supplier are defined, and their common areas of interest and conflict are analyzed in terms of requirements and capabilities. Questions of value arise in seeking to optimize system design. Thus, one must weigh the cost of complexity against its value to the user. In recognition of the importance of a logical structure for explaining the contents of a file, the authors observe that "the better the theory, the simpler the question which can be asked and the more complex the possible answer."

The final three chapters attempt to provide a theoretical foundation for design-

ing information systems. It is proposed that such systems be investigated by building mathematical models, so that their performance can be predicted quantitatively. Techniques which could be applied to the determination of similarity or relevance include symbolic logic, matrix algebra, and statistical analysis.

The emphasis, however, is almost exclusively on means for increasing the effectiveness of retrieval systems through improvements in the physical organization of files. Theories of logical organization are largely ignored except those based upon patterns of usage. In particular, the authors regard an *a priori* organization of descriptive terminology from a semantic viewpoint as being too confining and inflexible in any operational situation. Despite this, the book is one of the most informative yet to appear and is a welcome addition to the field.

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25 [X].—H. S. M. COXETER, *Regular Polytopes*, second edition, The Macmillan Company, New York, 1963, xix + 321 p., 23 cm. Price $4.50 (Paperback).

This second edition is essentially the same as the first edition of 1948, but in paperback by another publisher, with slightly larger pages and appreciably larger plates. Corrections and minor additions have been made, and six pages have been revised.

It still remains the most extensive and authoritative summary of the derivations and enumeration of the *n*-space generalizations of the regular and quasi-regular polyhedra. It includes their metric, topological, and group properties, and the history of their development. Although the subject of polyhedra is quite ancient, new discoveries concerning these polytopes have been made since the first edition, many by the author. Some of the new work is mentioned in the text and in the extensive bibliography.

A review of the first edition by the present reviewer appeared in *Mathematical Reviews*, v. 10, 1949, p. 261.

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26 [X].—OYSTEIN ORE, *Graphs and Their Uses*, Volume 10 of the *New Mathematical Library*, Random House, New York, 1963, viii + 131 p., 23 cm. Price $1.95.

This is an excellent introduction to graph theory. The exposition is elementary, although less so than that of most of the volumes of this series. The intended audience (for the series) of "high school students and laymen" may have some difficulty with a number of the proofs, but a reader with a little more mathematical maturity, who is seeking a simple introduction to the subject, could hardly do better.

There are nine chapters. In the list of these that follows we add in parentheses the problems to which the corresponding concepts are applied. 1. What is a Graph?