BOOK REVIEWS

Mathematical statistics. By S. S. Wilks. Princeton University Press, 1943. 11+284 pp. $3.75.

The aim of this book is to present, for advanced undergraduate or for beginning graduate students, a summary of the mathematical theory of statistics developed during the twenty years prior to April, 1943, with a minimum of excursions into applied mathematical statistical problems. Aside from this book and the author's *Statistical inference* published in 1937, most of the theory covered still exists only in the original contributions widely scattered in scientific literature. A reference list of literature for supplementary reading, which is appended, includes these contributions as well as some text books and several articles more than twenty years old. It is of interest to note that the author himself is responsible for nine of the 123 references.

As a matter of fact, the material summarized is not limited to developments since 1922, since a good many accepted principles and formulas are necessary to lead up to the newer developments or serve as particular illustrations. For the purpose in hand, this method of treatment seems desirable, but it is worth noting that the point of view is not historical and the book does not attempt the difficult task of tracing in detail the growth of understanding of new principles.

Subjects covered are a discussion of distribution functions, including the Stieltjes integral, regression, partial and multiple correlation, the normal distribution, the Pearson system, and the Gram-Charlier series; sampling theory, sampling from a normal population, including a discussion of the χ^2 distribution, the "Student" t-distribution, and Snedecor's F-distribution; the theory of statistical estimation, including confidence intervals and regions, point estimation and maximum likelihood estimates, and tolerance interval estimation; tests of statistical hypotheses; normal regression theory and its application to the analysis of variance, including the case of incomplete layouts; combinatorial statistical theory, including some discussion of the theory of runs, matching theory, independence in contingency tables, and sampling inspection; and an introduction to multivariate statistical analysis.

As would be expected from the author and sponsorship, the book is an important addition to available statements of mathematical statistical principles. The exposition follows accepted standards of generality and precision. The mathematical theorist will find and enjoy the consistent development of advanced mathematical theory based for the most part on concise mathematical formulation of the hypotheses used. Material that does not lend itself to precise mathematical statement is avoided and the steps which are not pertinent to a straightforward mathematical development of the subject are thrown out.

These latter procedures will not appeal to the practicing statistician who must often use material of a less precise sort and support his arguments by a presentation of alternative points of view. The practicing statistician will also regret that the description of the Pearson and Gram-Charlier distribution functions does not include any judgment as to how well these curves work in actual practice, or how much they reflect physical law rather than merely provide equations, one of which will describe fairly closely nearly any particular case. It will also be regretted that no problems are included in the text as published, although it is indicated that when revised and issued in permanent form, certain problems will be inserted at the ends of sections and chapters.

The reviewer would like to suggest a shift in point of view in order to make the book more helpful to applied statisticians, especially those working in the social sciences. It would seem desirable for the final form of the book to go even further than the author promises in assigning a place of importance to problems. Principles, especially in the field of applied mathematics, get their orientation from the problems to which they apply and the historical, as well as the psychological, approach begins with problems. It might also be desirable to adopt a broader view as to what are the problems of the statistician in which mathematical methods may be helpful. In the first paragraph of the introduction, modern statistical methodology is divided into two broad classes: first, routine collection, tabulation, and description of large masses of data, and, second, making predictions or drawing inferences from a given sample of observations about a larger population of potential observations. It is suggested that a three-fold division into description, analysis, and testing of results would more nearly fit the daily work of many practicing statisticians, and that their ordinary processes of analysis and testing might be greatly improved by use of more of the type of statistical reasoning developed in this book if the connecting links between abstract theory and practice were properly forged.

It is conceded that any author has a right to prepare his book to fit the need as he sees it and as he believes he can fill it. The above suggestions are offered in order to explore the possibility of such adjustments in point of view as might enable the advancement of knowledge to proceed without half a dozen layers of books between the theoretical mathematical statistician and the run-of-the-mine working statistician.

As the book stands, it fits the more important findings in the field of advanced mathematical statistical theory into their proper places in a unified treatment providing uniform notation and terminology. Such a treatment will clearly prove of great value to college and university students, and also will facilitate important technical statistical work.

The reviewer wishes to acknowledge gratefully the assistance of Dr. Bradford F. Kimball of the New York State Public Service Commission. It is to be noted, however, that Dr. Kimball does not necessarily agree with all of the conclusions.

R. W. BURGESS

A treatise on the theory of Bessel functions. By G. N. Watson. 2d ed. Cambridge University Press; New York, Macmillan, 1944. 6+804 pp. $15.00.

The first edition of this book was published in 1922 and was reviewed by Professor R. D. Carmichael (Bull. Amer. Math. Soc. vol. 30 (1924) pp. 362–364). At that time the book constituted an almost encyclopedic account of results concerning Bessel functions which had been obtained by various mathematicians during the previous century. Furthermore, it was written in such a manner as to be comprehensible for those readers in possession of the fundamentals of modern analysis.

The present edition makes no attempt to take account of additions to the literature during the period since 1922, and the changes are for the most part limited to correction of minor errors. However, the book still remains a very comprehensive account of the bulk of the literature on the field in question. It will undoubtedly be of great service to workers in pure and applied mathematics who have occasion to make use of the various formulas and theories connected with Bessel functions.

There exists, however, one rather curious gap in the original edition which has not been filled in the current one. The original investigation by Fourier of a problem concerning the flow of heat in a cylinder, which led to the development of an arbitrary function in a series of Bessel functions of order zero, is outlined in §1.5. Reference is there made to Chapter 18 for a discussion of the validity of the expansion. But in order to show that the solution which Fourier gave for his problem is really valid, it is necessary to establish the uniform