that if a trigonometrical series converges except in an enumerable set to a finite and integrable function, then it is the Fourier series of this function.

M. H. HEINS

The advanced theory of statistics. Vol. 1. By Maurice G. Kendall. Philadelphia, Lippincott, 1944. 12+457 pp. $16.00.

Modern statistics is built around sampling theory. It is not well presented by books in the tradition of a quarter-century ago which exalted an extreme and sterile empiricism and ignored or deprecated probability and mathematics in general, even when such books are revised to mention modern developments. Neither is it adequately presented in the books, now becoming available to research workers in an increasing number of fields, which give sound practical advice and formulae, but without the derivations. For the serious student of statistics nothing is wholly satisfactory short of a treatment starting from first principles and proceeding by fully stated definitions and derivations to the methods needed for the entire array of situations with which statistics deals. To get on as far as possible with this program has been the object of only a few of the many books on statistics. Of these, Mr. Kendall's is the largest, and covers in fullest detail the subjects treated.

In spite of the title, this book is not "advanced" in the sense of requiring of the reader a prior knowledge of statistics. It does call for more of a mathematical background than is possessed by most students of statistics. Anyone who has mastered advanced calculus should get along fairly well with it, though there are occasional uses of such relatively advanced mathematics as complex integration and evaluation of integrals by residues, the Euler-Maclaurin sum formula, Stirling's formula (which is used without proof or explicit statement), the integral form of the remainder in Taylor's theorem, and definite quadratic forms. For a reader who is not troubled by these purely mathematical matters the style is unusually clear and explicit. There are many illustrations drawn from actual observations. Each chapter ends with a collection of problems; these are of a superior quality, suitable for testing mathematical skill and mastery of the material, not merely numerical data to be substituted in formulae. The work therefore possesses qualifications as an excellent textbook for suitably prepared students in the hands of a suitable teacher. The teacher, however, should not only be prepared to help the students over the mathematical hurdles noted and others, but should also be enough of a specialist in statistics to apportion due emphasis to the various topics treated in relation to the wider theory and to applications. The book will also need supplementation from other sources, at least until the second volume appears, in order to cover some of the most essential parts of statistics.

Chapter 1, *Frequency-distributions*, provides a good introduction, and Chapter 2, *Measures of location and dispersion*, is rather exhaustive, though these two chapters seem to be influenced too much by tradition in contrast with the modern tendency to distinguish early and sharply between "sample" and "population," that is, between observations and probability distribution. Chapter 3, *Moments and cumulants*, includes a good account of Sheppard's corrections. Chapter 4, *Characteristic functions*, presents a careful and adequate treatment following in part that of Paul Lévy and including some of the limit theorems. Chapters 5 and 6 describe the binomial, negative binomial, Poisson, hypergeometric, normal, Pearson and Gram-Charlier distributions. Chapter 7 is entitled *Probability and likelihood* and makes some attempt to deal with fundamentals, though the main attack on them is postponed to the second volume. The chapter ends with a curiously misplaced proof by Cramér, under Lindeberg's condition, of approach to normality; this would seem logically to belong three chapters earlier. Chapter 8, *Random sampling*, deals chiefly with practical problems involved in making a sample random. Chapter 9 develops a considerable number of formulae for standard errors, exact and approximate. Chapter 10, *Exact sampling distributions*, illustrates various methods of obtaining such distributions, including the use of geometrical methods, of characteristic functions, and of mathematical induction. Chapter 11, *Approximations to sampling distributions*, contains a most intelligible and comprehensive account of Fisher's cumulants and the theory connected with them. There is an extensive table of cumulants of cumulants. Chapter 12 deals with the χ^2 distribution, with applications and approximations. Chapter 13 is on *Association and contingency*, Chapter 14 on *Product moment correlation*, Chapter 15 on *Partial and multiple correlation*, and Chapter 16 on *Rank correlation*. These chapters are comprehensive treatments and include nearly all published results of importance in their fields.

It is stated in the preface that the second volume will deal with the theory of estimation, regression, analysis of variance, tests of significance, multivariate analysis, theories of statistical inference, and time series. If these subjects are treated as comprehensively as those in the first volume, a substantial treatise covering the main body of the theory will be available.

The treatment is occasionally lacking in exactitude and rigor, though it compares favorably in this respect with many books on mathematics and mathematical physics, and is enormously above the general level of books on statistics. The volume is printed in England, with a rather luxuriously pleasing use of display formulae and wide margins on large pages. However there is no table of contents in this first volume, and typographical errors seem unusually numerous. A particularly troublesome one is the omission of the subscript n from v in the second integral in line 7 of p. 112; this should be remedied by each owner of a copy, since the meaning of the Helly-Shohat-Fréchet theorem is involved. The continued fraction for the normal probability integral is derived on p. 129 by Laplace's method instead of by the more satisfactory argument of Jacobi, and one of the useful series for this integral is not included at all. The advice on p. 336 not to use the standard error of the correlation coefficient unless n exceeds 500 is excessively conservative when ρ is small.

The author follows the practice of defining the variance of a sample as the simple mean of the squares of the deviations from the mean. This saves trouble for the author and the reader, in their capacities as such, but makes no end of trouble for them or anyone else who undertakes to substitute observations in the formula thus simply laid down. Use of a denominator less by unity than the sample number has distinct advantages.

Previous relevant writings are occasionally ignored—as often happens in a science built up from contributions scattered through multitudinous journals devoted largely to applications. The statement on p. 250 that no previous systematic account had been given of methods for deriving sampling distributions neglects a paper by B. H. Camp in the Annals of Mathematical Statistics for 1937.

With these qualifications, which can easily be taken care of by a competent teacher, or in later editions by the author and publishers, the book is an outstanding landmark and promises to be of the utmost value in advancing knowledge of the theory of statistics.

HAROLD HOTELLING

A handbook of perspective drawing. By James C. Morehead and James C. Morehead, Jr. Pittsburgh, J. C. Morehead, 1941. 3+166 pp. $4.50.

Perspective being a central projection, the *Handbook* denotes by *picture plane*, *station point*, and *station-point distance* the plane of