their respective contributions to statistics but he is unlikely to have any detailed knowledge of the interactions between these individuals, the influences acting on them or their fields of application. This is the subject of the present volume.

Part One of this book (158 pages) is concerned with the early development of the calculus of probabilities and the calculus of observations in the context of astronomical and geodetic data. Part Two (101 pages) is concerned with "the struggle to extend the calculus of probabilities to the social sciences", that is with the work of Quetelet, Lexis and Fechner. Finally Part Three (97 pages) is concerned with the work of Galton, Edgeworth, Pearson and Yule on regression and correlation.

For this reviewer the main thrust of this book is the successive development of the 'Gauss-Laplace synthesis' by Quetelet, Galton, Edgeworth, Pearson and Yule with particular attention being paid to the role of Quetelet and Edgeworth as intermediaries between Laplace and Galton, and between Galton and Pearson respectively, and to the role of the social sciences as a stimulus in the work of Quetelet, Lexis, Fechner and Yule. The 'Gauss-Laplace synthesis' itself receives a surprisingly brief (20 pages) discussion but, on reflection, I realised that a longer treatment would have overbalanced the work.

This volume is a work of considerable scholarship but the author wears his learning lightly and the result is a book that is compelling reading. I strongly recommend it to all students of statistics who are interested in the history of their subject.

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Empirical Processes with Applications to Statistics
G. R. Shorack & J. A. Wellner, 1986
New York, John Wiley
xxxvii+938 pp. £57.45
ISBN 0 471 86725X

As would be expected of any book having "with applications to statistics" in the title, this is essentially a highly technical book of mathematical probability. The applications are anything, in a very wide sense, to do with empirical distribution functions. It is from these that the other part of the title derives, since an 'empirical process' is a multiple of the difference between the empirical and the population distribution functions, where this difference is treated as a stochastic process.

The basic approach of the book is the traditional one of theorem and rigorous proof but, although a good discussion is given, reference is made elsewhere for proofs of several key results. Again, several of the many 'Exercises' liberally spread about the text are to prove important results. Given the size of the book, this shortfall from complete thoroughness at first appears surprising, and one wonders what takes up all the space. The answer is twofold: first, there is so much material to be covered and so many ways in which empirical processes can be studied; secondly, a lot of space is given to discussion of the meaning and interpretation of results and to trying to make clear the proofs and the ideas behind them. However, this is not a book to be picked up in the hope that all will be revealed with a light browse. The theoretical development starts from the assumption of a good grounding in measure-theoretic probability theory, at least for ordinary random variables, and develops that necessary for stochastic processes. Essentially, the book provides a detailed collection and overview of results for its chosen area, up to and including results from the recent probability journals: this will give some idea of the technical difficulty to be faced.

Overall, the presentation of the book is good except for two things: the numerical tables are derived from dot-matrix printer output which, although of relatively high quality, is still wearying to the eye, and it is difficult to refer between sections because of the lack of full numerical section headings. A number of points of notation are not defined, or are used before they are defined, and the list of special notation given could usefully be more extensive.

The major probabilistic theme is the convergence of the empirical distribution function, or rather the empirical process, to a limiting stochastic process as the number of observations increases: this turns out to be directly related to the Brownian bridge. A key consideration in establishing almost sure convergence, and the rate of this convergence, is the joint specification of the sequence of observations from which the empirical distribution function is constructed, and if the limiting stochastic process, in such a way that they exist on the same probability space. Extensive use is also made of martingale theory. It is reasonably easy to see that since the inverse distribution function gives the quantiles, any theory for convergence of the sample distribution function will be closely connected to one for convergence of the sample quantiles.

The 'applications to statistics' include treatment of: goodness of fit tests, and tests of symmetry, derived from the empirical distribution function; linear functions of order statistics; rank tests; test based on spacings; probability plots; parameter estimation by minimising a goodness of fit statistic. It is with the goodness of fit and symmetry tests that the book comes closest to having direct application to practical statistics, since tables of the asymptotic and small sample distributions are given for a whole range of statistics, including some for principal component decompositions of the test statistics and also including tables for use when parameters of certain families of distributions have been fitted. However, practical details such as how to compute the statistics from data are omitted. Much of the rest of the 'applications' can be regarded as being useful to the heavily theoretical end of mathematical statistics, partly because the various results are not tied closely enough together to allow any clear route to their practical application to be seen, and partly because the different types of test statistics are considered in such general forms without any specific recommendation or practical exemplification. The book gives a wide ranging coverage of the theory of all types of statistics derivable from the empirical distribution function for independent random variables, including the cases of random censoring and of residuals from both classical and robust regression. However, it should be said that much of the book is concerned with probabilistic niceties without any apparent application to statistics.

To summarise, this is a book for probabilists and for those researching into theoretical statistics, not for someone looking for straightforward advice about standard or recently developed approaches to data analysis.

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Statistical Inference in Linear Models

H. BURKE & O. BURKE, 1986
New York, John Wiley
614 pp. £39.95
ISBN 0 471 103349

This book was originally published in German in 1977 and aims to present the theory of linear models in a unified and coherent way. The scope of the book is encyclopaedic (everything from A-optimal Design to the Zellner model). The main body to the text discusses the position of statistical inference in a coherent and unified manner. The theoretical content of this volume is very high and the subject is developed rigorously: therefore it is quite a difficult and demanding read. This book is obviously intended as reference book rather than a teaching text and does not have any examples or problems.

The book begins with an introduction and surveys the basic ideas of statistical inference used in the book. In Chapter 2 the derivation of optimal unbiased estimators for linear parameters in various models, with an investigation of their properties. The third chapter considers the problem of improving the GLSE in a linear model when either the parameter space is restricted by equations or when the mean value is constrained to lie on an ellipse, cylinder and cone. Chapter 4 investigates the admissability of GLSE in certain special cases and demonstrates its improvement using non-linear estimators such as that due to Stein. The theory of linear hypothesis testing in both the univariate and the multivariate linear model is examined in Chapter 5. In the next chapter the general theory of confidence region estimation is presented. A consistent exposition of optimality and admissability results for confidence regions for linear parameters is provided in book form for the first time. The seventh chapter develops Bayesian methods and structural inference. A general theory of optimal design of experiments for regression problems is presented in the final chapter.

The book will require a high level of competency in theoretical statistics and its intended audience would seem to be advanced workers in this field.

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