confidence interval estimation of collections of functions of unknown parameters, an idea which, though not new in itself, is tied up with a new general test procedure called by the author his Type I test. While most " classical " multivariate theory is based on the likelihood ratio test, all statistical procedures in this book are based on this Type I test. In many univariate situations these two tests are the same. But as this is not always true in multivariate theory, the books by Professors Anderson and Roy do not cover the same ground.

In the opening chapters of his book, Professor Roy gives a general account of the Type I test and then considers its application to certain problems of multivariate normal theory, such as testing equality of mean vectors and of variance matrices. These applications involve the distributions of the latent roots of various random matrices and the book continues with the solution of distribution problems of this nature, under the appropriate null hypotheses. The powers of the critical regions of various Type I tests are then shown to depend on the latent roots of certain population matrices and lower bounds on the power functions of the tests are given in terms of these roots.

Thereafter the author deals with what he says is his primary object—the establishment of simultaneous confidence intervals for certain specific collections of parametric functions. These confidence intervals bear the same sort of relationship to the Type I tests discussed in the earlier part of the book as, for example, a confidence interval for an unknown mean bears to the t-test. They are obtained simply by " inversion " of the appropriate Type I test which is designed with this in mind.

A final chapter is concerned with " the statistical analysis of data in the form of observed frequencies in discrete (and finite) categories ", and there are nine appendices containing various results on matrices, transformations and integration used in the course of the book.

This book will be of interest mainly to research workers in statistical theory, as it is more in the nature of a progress report than a conclusive survey of the field. Those interested will no doubt already be acquainted with two papers * of 1953 which form the basis of the book. Professor Roy promises an extended edition or a sequel on further developments. S. D. SILVEY

ANDERSON, T. W., *Introduction to Multivariate Statistical Analysis* (John Wiley & Sons), 374 pp., £5.

This book is concerned with those statistical techniques in common use which are based on the assumption of underlying multivariate normal distributions. Professor Anderson classifies them into five categories and in the main part of the book he discusses methods in three of these, (i) correlation methods, (ii) analogues of univariate methods and (iii) methods involving suitable choice of coordinate system.

The theory of ordinary, partial and multiple correlation is covered under the first heading. Univariate methods whose analogues are discussed are these in everyday use which involve maximum likelihood estimates of means and variances, such as the t-test and analysis of variance. This second category includes quite a wide range of problems and involves, in particular, a full account of the generalised T^2-statistic and the Wishart distribution. Two main topics are discussed under the third heading, namely principal components and canonical correlations.

* S. N. Roy and R. C. Bose, Simultaneous Confidence Interval Estimation, *Ann. Math. Stats.*, **24**, 513-536.

S. N. Roy, On a Heuristic Method of Test Construction and its use in Multivariate Analysis, *Ann. Math. Stats.*, **24**, 220-233.

Outside these three main categories, Professor Anderson deals with classification problems and tests of the hypothesis of independence of sets of normal random variables. In a final chapter he reviews briefly various developments of multivariate analysis not included in the main text, including, in particular, factor analysis.

All the mathematical theory (both " population " and sampling theory) underlying the methods discussed is included. Naturally much use is made of matrices and while an appendix summarises the matrix theory involved, a fairly thorough knowledge of this theory is a prerequisite for the study of the book. The main inference methods adopted are maximum likelihood estimation and the likelihood ratio test and here knowledge of the properties of these methods for univariate situations is assumed. (In the problem of classification some use is made of decision function theory but a very clear and concise account of the necessary part of this theory is given in the text).

Professor Anderson's book is notable for clarity of exposition. Overall clarity is maintained by his classification of multivariate methods. Each chapter has an excellent introduction providing motivation. Illustrative numerical examples are included wherever necessary, and there is an adequate supply of problems for solution. There is no doubt that this book will be of great use to statisticians both for teaching and for reference. S. D. SILVEY

SCARBOROUGH, JAMES B., *The Gyroscope—Theory and Application* (Interscience Publishers, New York and London, 1958), pp. xii+257, $6.50.

There is at the present time a considerable reawakening of interest in the gyroscope and its applications, aroused no doubt by the widespread use of gyroscopes in guidance and stabilisation mechanisms. Equally it must be admitted that, possibly on account of other demands on their time, students of applied mathematics, physics and engineering are today, on the whole, not so well trained in three dimensional rigid dynamics as their predecessors of thirty years ago. In his book, which is for the most part a specialist treatise on the gyroscope, Professor Scarborough recognises a possible lack of preparation in basic mechanics on the part of his readers, and his first two chapters are accordingly devoted to a quite adequate account of the necessary vector algebra, and of the dynamics of a rigid body rotating about a point. There follow two chapters on the elementary theory of the gyroscope both free and moving under the action of gravity.

The remaining and principal part of the book is devoted to a description of various applications of gyroscopic principles—grinding mills, the gyroscopic compass, gyroscopic steering and various gyroscopic stabilisation systems. Thus part of the book abounds in practical examples, in which typical modern gyroscopes are used to provide the numerical values. Essentially this is an elementary book on the single gyroscope, not touching on general problems such as the stability of systems containing gyrostats.

Within its limits it certainly provides an excellent and very readable account of the subject. The publishers are rather unfair to the classic treatise of Andrew Gray, however, when they refer to the present book as " for the first time in the English language a sound, reliable account of the fundamental theory of the gyroscope and its more important applications ". J. C. GUNN

MAXWELL, E. A., *Fallacies in Mathematics* (Cambridge University Press, 1955), 95 pp., 13s. 6d.

The professed aim of this book is to instruct through entertainment. The author takes a number of interesting fallacies in mathematics, gives the argument