The author distinguishes two basic types in this framework: "prediction" and "decision-proper".

After an introductory chapter on the need for simplification and the problems of optimal and exact *vs.* inexact simplification, the author, in his second chapter, investigates the reduced-form prediction models. He presents a quadratic forecasting error criterion by which the optimal (or near-optimal) partition of the predetermined variables, and hence of the parameter matrix, can be identified. The theoretical setup is applied to the well-known Goldberger 1959 data.

He then turns, in his third chapter, to input-output analysis where the optimal simplification problem is indeed most severe, not to say, of vital importance. Again, by means of quadratic loss functions the simplification problem is reduced to one of finding a single optimal partition of the sector gross output vector, where the final demands are assumed to be known up to a constant of proportionality.

The numerical experiments undertaken in finding the optimal partition of the Morgenstern-Balderston-Within 18×18 matrix are reported.

The fourth chapter is devoted to the "decision-proper" models; these are decision models which contain decision variables and objective functions "explicitly derived from economic criteria" (p. 69) – contrary to prediction models, where the objective functions are taken as functions of the prediction errors. The "decision-proper" model most thoroughly discussed by Fisher is the linear programming model where activities as well as constraints are subjected to aggregation. His theoretical findings are numerically applied to the representative firm problem; i.e. it is attempted to select the strata of firms by a systematic optimization procedure. Some conventional optimization problems, where "the optimal detailed decisions can be obtained by the use of the calculus" are treated as quadratic decision problems "because the smooth quadratic functions are also very simple and beautiful" (p. 89).

The fifth chapter, entitled "A clustering method", consists of a discussion of the problem of an optimal or near-optimal partition of "a given set of points in a space of many dimensions, such that a certain quadratic distance criterion is minimized" (p. 99). In a sense, it may be regarded as the theoretical "Überbau" to the optimal simplification problem.

In the sixth chapter ("Related matters") the aggregation problem in fields outside economics and methods similar to Fisher's are shortly considered. In the seventh chapter ("Conclusion") it is worth mentioning Fisher's "skewness principle" ("practically all of the partitions arrived at as solutions to the various problems are, in a sense, *skew*" p. 136) and his "homogeneity *vs.* independence principle". Both principles are fundamental for the theory of clustering and aggregation in economics, and indeed are main themes of this book.

In an appendix the data material is listed, some of the simplification procedures are outlined, and some mathematical tools are discussed, among others: rank restrictions and simplification, and separability and Hessian matrices.

This lucidly and convincingly written book is indeed an indispensable reading for all statisticians.

Heidelberg G. Menges

Hillier, Frederick S. The Evaluation of Risky Interrelated Investments. Amsterdam: North Holland Publishing Co., 1969, 113 pp.

The problem of optimal investment planning for interdependent risky projects is easy to formulate but difficult to solve. The object is to maximize the expected utility of cash flows which are functions of zero-one variables, i.e. the investment levels. For linear utility functions expected utility reduces to present value. With suitable approximations, the investment problem can be reduced to a sequence of linear programs where the decision variables may take on values between zero and one. This approach leans on the method of Weingartner for capital budgeting under certainty. A better representation of the element of risk is achieved through chance-constrained linear programming. For problems of moderate size an exact integer program can be solved by means of branch and bound. These alternatives are fully explored in this admirable monograph. There is much additional material here of great interest such as an investigation of the conditions under which the probability distributions of cash flow are approximately normal and a number of theorems – groups under necessary conditions for optimality – about concave utility functions in conjunction with symmetric distributions containing only mean and variance as parameters.

This book has won a prize of the Office of Naval Research. It is compactly written, yet easy to follow and nicely organized. It should be required reading for every Management Scientist and can be recommended also to statisticians interested in applications.

München M. Beckmann

Kendall, M. G. Rank Correlation Methods (fourth edition). London: Charles Griffin, 1970, viii + 202 pp.

This is the fourth edition (the third appeared in 1962) of a well-known and standard book on the part of non-parametric inference covered by the title. The chief changes is the extension of the table of the exact distribution of Spearman's coefficient to $n = 11, 12, 13$ (the distribution of Kendall's coefficient has already been extended to $n = 40$ by Kaarsemaker and van Wijngaarden). There are also a number of new references but it is noticeable that the latest of these appears to be in 1963. This suggests that interest in the theory of the subject, however useful in practice, has waned. This seems a pity as there are some useful unsolved problems

remaining. In particular it should be possible to obtain by purely empirical methods a slight algebraic transformation of Spearman's coefficient which would enable it to be tested with very high accuracy from a table of the normal distribution. It would also be very valuable to obtain estimates of the distribution in the non-null case by Monte Carlo methods.

Canberra P. A. P. Moran

Kshirsagar, A. M. Multivariate Analysis. New York: M. Dekker, 1972, xiv+534 pp.

In its structure and substance this work resembles very much T. W. Anderson's classical "An Introduction to Multivariate Statistical Analysis" (J. Wiley, New York, 1958 [first edition]). A glance at the tables of contents is sufficient to reveal the congeniality of the books; the lists are (apart from the sequence of the sections) almost identical. Kshirsagar's monograph is subdivided in eleven chapters with the following titles: Regression and Correlation Among Several Variables (22 pages; An Introduction with emphasis on regression analysis); Multivariate Normal Distribution (24 pages; the usual basic material on the normal distribution; this section also contains a useful short survey on the theory of quadratic forms in normal variables). The Wishart Distribution (36 pages; a lot of information on only a few pages); Distribution Associated with Regression (38 pages; including a discussion of H. Ruben's recent results on the distribution of the sample correlation coefficient); Hotelling's T^2 and its Applications (66 pages; with a large section on applications of this distribution); Discriminant analysis (60 pages); Canonical variables and canonical correlations (42 pages; starting with the singular-decomposition technique of I. J. Good); Wilks' Λ Criterion and Its Applications (52 pages; even mentioning Y. S. Lee's results, published in 1971 (!)); Multivariate Analysis of Variance and Discrimination in the Case of Several Groups (59 pages); Likelihood Ratio Tests (24 pages; a rather short section on this topic of great practical importance); Principal Components (45 pages; very complete references).

In essence, this is a book on the distributional problems related with multivariate statistical analysis. Its main usefulness lies certainly in the fact that it contains many results not available in book form so far. Special features of this text are the heavy emphasis on the regression-analytic aspects of the theory, quite complete historical notes to most of the main theorems, and good references to published examples. (The book treats exclusively the theoretical aspects of the subject and doesn't contain any worked-out numerical illustrations.)

The author prefers analytical rather than geometrical methods (as opposed to A. P. Dempster in his book "Elements of Continuous Multivariate Analysis", Addison Wesley, Reading, 1959). Especially valuable for the research worker is the large part of the work (56 pages) entitled Exercises (The title "Complements" would seem to be more appropriate). This section is in fact a summary of 85 results on problems of the theory of multivariate distributions, most of them obtained in recent years and widely scattered in the statistical literature.

Some misprints and minor technical inaccuracies should not seriously deter the reader from understanding the text, which over-all is very clearly written. On the whole this monograph is an excellent addition to the literature on multivariate statistical analysis and I recommend it to everyone interested in this fascinating subject.

Bern, Switzerland Franz Streit