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Book Review

Applied Regression Analysis, by N. R. DRAPER and H. SMITH, 1966; 407 pages. (New York: *John Wiley & Sons, Inc.*, 90s.)

It is probably true that to-day more than 90% of the time spent in applying statistical methods by means of computers is occupied by fitting to data relationships involving several variables, i.e. regression analysis. There is nothing surprising in this high proportion, for the technique of regression is attractive and simple as a descriptive technique in many important economic and industrial situations. Unfortunately, however, the interpretation of the results of the application of this technique can be a highly complex matter. Whilst admitting that the volume of activity in applying regression analysis has increased substantially since the introduction of computers, it is also necessary to realise that the amount of guidance provided for users of such a technique by textbooks has not increased commensurately. It is therefore refreshing to encounter a book which is not a conventional and theoretical introduction to regression analysis. As well as providing such guidance in good measure the book at present being reviewed has three particular virtues. These are an emphasis on the analysis of residuals, an account of current methods for selection of best regression models and a most welcome and uncommonly extensive section on non-linear regression. In those situations where multiple regression has been tried and found to give puzzling and unsatisfactory results, it has not been common practice in the past to evaluate the residuals or deviations from the model because of the computational exercise involved in such evaluation. The examination of residuals, it is shown, may be assisted by applying certain formalised procedures of the type given in this book. For this essential part of regression analysis graphical output is of course indispensable.

In an interesting chapter, various step-wise and stage-wise regression techniques are described with worked examples, and personal conclusions are drawn by the authors. The sheer quantity of computer output is staggering with some of the fifty pages spread rather thinly with small tables. To some extent, this amount of output is defensible on the grounds that in order to compare methods for selecting the best regression equation in a particular situation, a student usually must examine a considerable volume of output. It must be added in fairness to the authors that their discussion of selection techniques is very reasonable and they give sufficient warning of the dangers of applying these techniques in a routine manner.

Many non-statisticians will be interested in the survey of non-linear minimisation presented in the last chapter, and most of the recent papers appearing in this *Journal* and elsewhere are discussed here and cited in an excellent 'non-linear' bibliography.

The level of statistical knowledge assumed is not great and although matrices are used extensively to describe the procedures, they are carefully introduced and extended by illustration. Simple matrix properties are described and formulae are given for the inversion of special and small-order matrices. The book would be suitable for a course on the application of regression analysis assuming computing facilities were available. It is nevertheless doubtful whether this book could itself provide sufficient basis for training a specialist in this area, because of its lack of underlying theory. In its defence the book does usually refer to suitable texts and research papers, and the coverage of the bibliography is excellent. There are useful numerical examples for the student at the end of most chapters with solutions at the end of the book. Except for the arrangement of some of the computer output already mentioned, the presentation of the book is excellent. The book is also to be recommended as a general reference for anyone in the computing field who meets statistical applications, and for practical statisticians.

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