The book closes with a chapter on specification testing. The tests for model adequacy include the RESET test, Chow's test, and a test of postsample predictions. For discriminating between models, Amemiya's prediction criterion and Akaike's information criterion are described. Lagrange multiplier and likelihood ratio tests are discussed for nested models, as well as several tests for nonnested models. Chapter 14's last section describes and illustrates Hausman's test for the exogeneity of regressors.

References and a subject index are provided, but the total absence of statistical tables will be a nuisance for any user. Surprisingly, the book does not include any exercises or additional data sets, a serious drawback in an introductory textbook. The book's price is discouraging high for anyone wishing to add this book to his or her personal library; on orders of magnitude, foreign, for classroom use only, the price is $45.

Other books about the same level all contain at least one chapter on simultaneous-equations models. Gujarati (1988) included enough material for two semesters, adding the matrix approach to linear regression in an optional chapter that can be omitted without loss of continuity. Maddala (1988) detailed (without using matrices) developments in econometrics since his earlier book (Maddala 1977). Johnston (1984) and Kmenta (1986), whose books are at a somewhat higher level than this one, used matrix algebra extensively. Integrating a computer program into the text—as this book does—is an approach taken by Wallace and Silver (1988). Wonnacott and Wonnacott (1979) employed the geometrical approach to regression effectively, a strength not shared by this book.

Overall, it seems doubtful that this book will replace existing textbooks in many introductory econometrics courses. It may serve as a supplement in a course on applied regression analysis for business and economics in which Minitab is used.

FARID KIANIFARD
Plymouth State College

REFERENCES

Theoretical and Computational Aspects of Simulated Annealing


The algorithms collected under the general category of simulated annealing are among the most exciting algorithmic developments of the decade. These flexible, easy-to-code algorithms are theoretically attractive, their basic link probability and optimized annealing and then provides insights for research in three directions: finite time behavior of simulated annealing, empirical analysis, and a Bayesian approach to simulated annealing. The volume grew out of a doctoral dissertation written under the direction of Jan Karel Lenstra and Alexander Rinnooy Kan, two leaders in the field of combinatorial optimization. Although it has not completely outgrown its origins as a thesis, the work stands as a valuable research monograph that libraries should acquire and investigators in optimization should examine.

J. MICHAEL STEELE
Princeton University

Order Restricted Statistical Inference

Order-restricted inference consists of statistical procedures derived under assumptions of prior order information concerning the model (parameters). A simple example of such a procedure is the test of equality of two (normal) means against the one-directional alternative that one mean is larger than the other. A more complex example would be estimating a dose-response curve when it is known that the mean is non-decreasing in the dose. The landmark research monograph on inference under order restrictions is by Barlow, Bartholomew, Bremner, and Brunk (1972). Their book summarized research in this then relatively new field.

Robertson, Wright, and Dykstra, the academic second generation of Barlow's students, identify their goal in writing this book as ‘supplementing a book which is otherwise difficult to use’ (p. vii). Like Barlow et al. (1972), this is a research monograph. The authors focus their attention on procedures that are based on the likelihood principle (p. xi), together with a selection of other topics reflecting their research interests. The extensive bibliography lists works cited in the text plus additional articles on the subject. Each chapter concludes with a ‘complements’ section summarizing avenues of research that have been pursued in the literature but not described in the text. The book does not contain problems; they would have been useful for those wishing to use it as a topics-course textbook. Although the book is self-contained, students will find the mathematical maturity gained from a course in mathematical programming helpful.

The nine chapters and a useful index to notation. The organization mimics that of Barlow et al. (1972). For example, Chapter 1 ("Isotonic Regression") discusses perhaps the most easily motivated isotonic inference problem, that of estimating a regression function defined on a finite set under order restrictions. After introducing simple orders, partial orders, and quasi-orders, the chapter discusses maximum likelihood estimation (MLE) for exponential families, and the normal, binomial, and multinomial problems in particular. In addition to formulas for the MLE, it presents geometric interpretations of the MLE and computational algorithms. Finally, Section 6 shows that the isotonic MLE has smaller mean squares error than the nonisotonic MLE (the same is true for general convex loss functions). Discussion of large-sample properties (consistency and asymptotic normality) is deferred until Chapter 9, as is discussion of Bayesian procedures.

Chapters 2–4 and much of Chapter 5 study testing problems. Chapter 2 ("Tests of Ordered Hypotheses: The Normal Means Case") considers the case of k normal populations, which is important in its own right and as a limiting case in many applications. Attention is restricted to likelihood ratio tests (LRT), except in Chapter 4 (see the following). In addition to the hypotheses of homogeneity and isotonicity, the hypothesis of arbitrary nonhomogeneity is considered. Thus two testing problems are studied. The first is the LRT of homogeneity versus isotonic alternatives and the second is the null hypothesis isotonicity versus the global alternative. The latter is emphasized as a model-testing tool (subject to the usual warnings about multiple inferences on a single data set). The important cases of simple ordering and simple tree ordering are considered in detail. The classical material on the null distribution of the test and its power function are covered. Newer results on the monotonicity of power function as one moves farther away from the null hypothesis, unbiasedness of the LRT, and proofs of consistency are presented. It is well known that the null distribution of LRT’s in such problems are convex combinations of independent χ² or F distributions, according as the null hypothesis is on a fixed or on an open boundary. Considerable information is included regarding the evaluation of the relevant probabilities that was not given by Barlow et al. (1972). The book contains 21 tables of critical points of the χ² and E distributions, whereas Barlow et al. included no tables. Tables for the cases of simple ordering and simple tree ordering both with equal and unequal sample sizes are particularly well covered. The classical isotonic orderings of Chapter 2 concern the geometrical ordering of the LRT statistic for both types of cases. Additional results for unequal sample sizes are described. A new feature of this book is a discussion of recent work on LRT’s for isotonic structures, specifying that the vector of means belongs to a polyhedral cone.

Chapter 3 ("Approximations to the χ² and E Distributions") contains results concerning approximations to the null and alternative distributions of the LRT statistic for both types of cases. In addition to theorems, bounds for the null-distribution tail probabilities are described. Though some approximations are given for the ξ² distribution by Barlow et al. (1972), most of the material in this chapter is based on research since 1972.