they can indulge in more advanced material. Each time I taught the course differently. I used three different textbooks, and never really felt satisfied with how the material was covered.

When Gallant's book crossed my desk, I was convinced that the author must have felt the same way and had taken the initiative to publish a book from class notes. In the Preface, the author makes it clear that the book is calibrated to the task of preparing first-year graduate students for their courses in econometrics, microeconomics, and macroeconomics. He has succeeded marvelously in this task. The material is intended to be taught in a one-semester or a two-quarter course. What is covered are prerequisites for later courses; namely, the book provides students with a fundamental understanding of probability and mathematical statistics and gives them intuition about the foundations of econometric analysis. The book also helps students decide whether they want to pursue econometric theory as a dissertation topic or take advanced topics courses in the area.

The book has five chapters. Chapter 1 considers the measure-theoretic foundations of probability. The chapter starts out in a rather unconventional way with a discussion of two games of chance: craps and keno. The idea is to make the reader aware of simple situations where a game of chance can last forever; that is, the dice may be rolled indefinitely in craps and the game never decided. The author provides considerable detail about these two games. They were chosen as examples because, to use his words, they are real and tangible and aside from Las Vegas, Reno, and Atlantic City, people have been playing these games in something close to their current form since at least the time of the Crusades. The examples of craps and keno are somewhat intimidating to teach for someone like myself who has barely set foot inside a casino. Fortunately, the chapter contains several other motivating examples, some conventional, like coin tossing, and others less straightforward, like the triangular map where nothing is random. I like the diversity of examples developed here and the common thread that binds the chapter.

Chapter 2 covers random variables and expectation. Keno examples are rehashed in this and later chapters, yet one can easily substitute other examples if so inclined. The chapter covers the definition of a random variable as a measurable function on a sample space and explains its purpose. Standard concepts such as Borel σ algebras and measurable functions are introduced. Continuous and discrete random variables and unconditional and conditional expectations are treated in subsections. Not all results are rigorously proven. Indeed, in this as well as the other chapters, the author states many results without proof. Yet whenever the steps of a proof provide useful insight, details are included. In Chapter 2, for instance, proofs of the monotone convergence theorem and of several properties of measurable functions are not provided, but the law of iterated expectations and the property that a conditional expectation minimizes the mean squared prediction error are proven.

Chapter 3 deals with distributions, transformations of random variables, and moments. The material is close to what can be found in many standard probability and statistics textbooks, yet there is less total material here. For example, many of the standard distributions are mentioned but not covered in great detail. One useful feature of this chapter is its use of matrix notation in the treatment of the multivariate normal distribution. In many textbooks (such as Hogg and Craig 1995), matrix notation is not introduced when the multivariate normal distribution is first discussed.

Chapter 4 discusses four modes of convergence: almost sure convergence, convergence in probability, convergence in distribution, and L_p convergence. It is the book's shortest chapter and is written clearly. Chapter 5, on statistical inference, is probably the most challenging chapter to teach. The basic ideas of estimation and hypothesis testing are covered. This chapter is clearly meant as a springboard into more advanced econometrics courses. The maximum likelihood estimator is, for the usual reasons, discussed in detail. I like how the author also wanders into advanced topics such as simulation-based estimation. He also devotes a section to Bayesian estimation. It is obviously more demanding to teach this material concisely.

Overall, I have great praise for *An Introduction to Econometric Theory.* Although it targets economics departments and business school Ph.D. programs, it could also reach a broader audience. In that regard, the book's title may underrepresent its potential usefulness in other disciplines.

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Bayesian Statistics: An Introduction.

P. LEE. New York: Wiley (2nd ed.), 1997. ISBN 0-471-19481-6. xii + 344 pp. $39.95 (P).

The horizons of Bayesian statistics have expanded sharply in the 1990s, largely because Markov chain Monte Carlo methods have made the fitting of complex, high-dimensional models and the use of nonconjugate prior distributions computationally feasible. Published in 1989, the first edition of Peter Lee's book preceded this explosion. This second edition incorporates new material on hierarchical models and current computational methods. However, the book's most valuable features remain its clear exposition of Bayesian theory and rational discussion of the differences between Bayesian and frequentist approaches.

Because of its focus on Bayesian statistical theory, the book would appear to be targeted primarily at statistics and math students. The Preface states that the student is expected to have "a knowledge of calculus of one and two variables and a fair degree of mathematical maturity" but "no very detailed knowledge of classical statistics" (p. xi). In fact, some previous familiarity with the fundamental concepts of probability (including conditional probability, discrete and continuous random variables, density functions, moments, transformations of scalar variables, etc.) is also needed to make the book accessible. Although Chapter 1 offers an excellent review of the basics of probability, its 27 pages are too terse to provide an adequate introduction. Two sections of the book, both concerned with general linear models, assume knowledge of linear algebra. However, these sections could easily be omitted in a course that required no such prerequisite, because correlation, regression, and analysis of variance are presented elsewhere in the text without the use of matrix theory.

The book's first seven chapters remain essentially as described in the review of the first edition (Polson 1990). The second edition differs from the first primarily in the addition of two entirely new chapters, an increase in the number of exercises, and an updating of references. The new Chapter 8 introduces hierarchical models, focusing on normal means and normal linear models. In this context, empirical Bayes methods and Stein estimators are also discussed, with the caveat that neither are Bayesian procedures. Finally, Chapter 9 introduces computational methods for Bayesian statistics, specifically the EM algorithm, data augmentation, the Gibbs sampler, rejection sampling, and the Metropolis–Hastings algorithm. Although the presentation of the EM algorithm and its example application to finding posterior modes in a hierarchical normal means model is clear, the remainder of this final chapter lacks the careful motivation and organization of material that characterize earlier parts of the book. The exercises following each chapter are well designed and challenging, requiring conceptual understanding as well as mathematical skill. Substantive errors in the first edition appear to have been corrected. However, typographical errors are frequent, particularly in formulas, and sometimes severe enough to confuse the reader.

The Preface to the second edition directs the reader to a World Wide Web page at url http://www.york.ac.uk/~ pml1/bayes/book.htm. (The book's typeface makes the "l" and the "1" indistinguishable). The web page provides complete solutions, not just final answers, to all exercises (although some instructors may not consider this a good thing), as well as computer code in C++ or C for certain examples and exercises in the chapters on hierarchical models and computational methods. The listing of corrections for errors and misprints, which appears to be updated whenever an error is reported, definitely should be printed and kept with the volume.

If one already owns the first edition of this book, I would not recommend purchasing the second edition. The first seven chapters, focusing on Bayesian theory, remain the book's strongest parts. More satisfying coverage of the new topics added to the second edition can be found in two recent books on Bayesian data analysis, those by Carlin and Louis (1996) and Gelman, Carlin, Stern, and Rubin (1995).

In summary, *Bayesian Statistics: An Introduction* provides a thorough and thoughtful introduction to Bayesian statistical theory and would be an excellent textbook for a course in Bayesian mathematical statistics at the advanced undergraduate or early graduate level. Even for a course oriented more toward applications and data analysis (for which Gelman et al. 1995 would be a more appropriate primary textbook), this book would provide a helpful additional resource.

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The Analysis of Proximity Data.

B. S. EVERITT and S. RABE-HESKETH. New York: Arnold/Wiley, 1997. ISBN 0-340-67776-7. ix + 178 pp. $64.95 (P).

Proximity means closeness or nearness in space, and the concept is thus immediately identified with geometrical distance. But distance can mean more than maps and geometry. We speak of distant relatives, distant points in time, or a distant demeanor, and two politicians who cannot agree may be said to be far apart in their positions; their views are distant. Proximity covers many bases; agreement, disagreement, similarity, dissimilarity, resemblance, difference, accord, discord, congruence, correlation, covariance, correspondence, and so on, are all variants of roughly the same thing—proximity. We may evaluate proximity in myriad ways; measuring distance is just one possibility. For example, confusions, latencies, and reaction times can serve as indirect measures of a person's judgment of the similarity of pairs of letters; we may easily mistake an "n" for an "m" while reading, but rarely an "x" for a "q". Such data are important to experimental psychologists, who have been the main developers of methods of analyzing proximity data. Market researchers, archeologists, linguists, biologists, historians, and many others have also found the methodology useful.

Brian Everitt is well known for his expository texts. With more than a dozen monographs, geared mainly towards researchers in the medical and behavioral sciences, he is one of the more prolific writers on applied statistics. He is also joint editor of *Statistical Methods in Medical Research* and an editor of Wiley's forthcoming *Encyclopedia of Biostatistics.* His previous work is marked by clarity and conciseness, and (with co-author and departmental colleague Sophia Rabe-Hesketh) these qualities are in evidence in the present edition, fourth in a topical series designed to complement the classic three-volume *Advanced Theory of Statistics* by Kendall and his collaborators. The monograph is accessible to anyone with a basic knowledge of matrix algebra, and the examples, drawn from many disciplines, will engage the practitioner.

Analysis of proximity data involves a variety of techniques applied to a diversity of data. Traditional multivariate procedures for the analysis of correlations and covariances certainly qualify, but these have been widely studied and described by statisticians and are not discussed here. Rather, the focus is on two distinct but complementary approaches, one geometrical and the other graph-theoretic.

If proximities are like distances, then it seems natural to seek a spatial representation. The authors devote the bulk of their tract to multidimensional scaling procedures that construct geometrical representations of the proximity relations among objects. Imagine that you have a map of North America and are asked to determine the distances among 20 cities. This is a simple task if you have a scale or a ruler. Now imagine that you have no map but are given the 190 distances between the 20 cities and are asked to construct the map. The task is made more challenging by giving only the rank order of the distances. This is the essential problem of multidimensional scaling. In practice the representation is not confined to the plane, but because the procedure is most valuable as a visualization tool, low-dimensional embeddings are preferred.

There are many variations on the basic theme. Elaborations include multiple proximity matrices; replication and systematic variation are both considered. Incomplete data, which are certainly feasible, are not. Various procedures to aid interpretation are described, including an excellent section on Procrustes procedures for stretching, shrinking, and rotating configurations of points. Inferential theory is rare in this branch of data analysis, but Ramsay's maximum likelihood solution is included and illustrated.

Two particularly troublesome forms of distance-like data are treated: asymmetric and rectangular matrices. Although the distance from Toronto to Vancouver is the same no matter which city represents the starting point, the flight time is not, due to winds aloft. The flight-time relation is asymmetric while the distances cannot be; hence fitting a geometrical model requires some ingenuity! Also, although we usually think of map construction in terms of locating a set of points to match the interpoint distances, could we do so by using only the intrapoint distances between two distinct sets of objects? This is possible, but the representation is much more sensitive to error in the data as well as to the nature of the unknown configuration and the size of the associated rectangular proximity matrix.

The authors are to be commended for squeezing much material into a small space. However, it is inevitable in a slim volume that important work will be omitted, and there are lacunae. For example, although classical metric scaling methods are well covered, it is disappointing not to see the pioneering contributions of Richardson, Messick, and Torgerson properly recognized. Without these three, the purely mathematical theorems of Young and Householder would not have come to the attention of psychologists, and the exciting period of innovation in the 1950s and 1960s might never have occurred. Shepard's contribution, which followed directly on the classical work, would have been less likely; his splendid insight that geometrical representation was possible without metric data fueled a rush of papers from the 1960s through the 1980s. Efficient algorithms and elaboration of the model were to come from others, yet these were lesser achievements.

Nonspatial models for distance-like data are also common, with trees an especially popular choice. Hierarchical clustering schemes come immediately to mind. Graph-theoretical representations of proximity data are at least as old as the more obvious geometrical approach, and the treatment of this class of models is especially welcome. The authors do an excellent job of defining and illustrating additive and ultrametric tree models, showing how they form a useful complement to multidimensional scaling. They follow Shepard in presenting a well-known example involving similarities among animals where both representations share the same diagram.

A useful feature is the Appendix that catalogs computer programs. Variants of the two best developed and most versatile routines, ALSCAL and MULTISCALE are easily found in SAS and SPSS. Other general purpose statistical packages include multidimensional scaling routines, but their quality is variable—caveat emptor. Many of the more specialized computer programs would be harder to track down without this appendix, which gives web locations for most routines.

Both statisticians and practitioners new to the analysis of proximities should start with this well-organized and interesting monograph. Misprints are infrequent, and the general production quality is excellent. Though not inexpensive, the book represents good value and could serve as a textbook in a short course. Recent complementary texts that may also be of interest to statisticians are those by Borg and Groenen (1997) and Cox and Cox (1994).

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