Book Reviews

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Editor Reports on New Editions, Proceedings, Collections, and Other Books

Experiments: Planning, Analysis, and Parameter Design Optimization, by C. F. Jeff Wu and Michael Hamada, New York: Wiley, 2000, ISBN 0-471-25511-4, xxviii + 630 pp., $89.95.

This well-written book focuses on many new methodological developments since 1978 in design of experiments. The authors feel that 1978 was pivotal since the now classic *Statistics for Experimenters*, by Box, Hunter, and Hunter, was published that year. New methodologies discussed include robust parameter design, minimum aberration criteria, experiment designs with complex aliasing, and use of general linear models (GLM) and Bayesian methods for analyzing nonnormal data. Other designs that have received scant attention in the past are also discussed in detail including mixed two- and four-level designs, the method of collapsing for generating orthogonal main-effect designs, Plackett–Burman designs, and mixed-level orthogonal designs. As the authors state in the preface, their main goal in writing this book is to describe these less familiar methods and to propose a new and integrated system of designed experimentation and analysis. The intended readership includes general-design-of-experiments practitioners and specialists.

Chapters 1–4 review many standard methods such as regression, analysis of variance (ANOVA), randomized block designs, transformation of response variables, and full and fractional factorial experiments at two levels. In Chapter 3, I found the discussion of the differences between normal and half-normal plots useful. Half-normal plots are used throughout the text to illustrate location and dispersion effects. Lenth's method, a quantitative approach to testing effect significance where the control of individual error rate is important, is presented as a supplement to half-normal plots. Chapter 3 also discusses three fundamental principles of factorial effects that are referenced throughout the book—hierarchical ordering (lower-order effects are more likely to be important than higher-order ones), effect sparsity (number of important effects is small in a factorial experiment), and effect heredity (if an interaction is significant, at least one of its parent factors should also be significant). Chapter 4 discusses *D*-optimal designs along with some software packages that can be used to apply these designs to very large problems. A detailed discussion of the minimum aberration criterion is also presented. Use of this criterion to identify fractional factorial designs with maximum resolution is emphasized.

Practical reasons for choosing a three-level design including the need to investigate curvature effects are presented in Chapter 5. A highlight of this chapter is the use of out-of-spec probabilities to optimize multiple responses. Chapter 6 describes the use of mixed two-level and four-level factors, which are particularly useful designs for examining both quantitative and qualitative factors. This chapter also describes the use of factors with sliding levels, useful if one wants to avoid a bad region of design space and/or to minimize or even to eliminate interactions. Chapter 7 focuses on the utility of nonregular designs, containing factors that are neither orthogonal nor fully aliased, when run size economy is important. Such designs are flexible if factors with different numbers of levels are desired. One class of designs, the Plackett–Burman designs, contains complex aliasing relationships and is described in detail. Chapter 8 describes two strategies for analyzing experiments with complex aliasing. Both the frequentist and Bayesian strategies work well if the number of interactions partially aliased with main effects is small. In general, these designs are used mostly for screening main effects.

Chapter 9 is a very readable description of response surface methodology (RSM). This very broadly applicable approach is useful for response optimization and/or for gaining insights into the underlying mechanisms that govern relationships between input factors, particularly if the number is small, and a response. A lucid description of canonical analysis for understanding configurations of second-order response surfaces is presented. The use of desirability functions for optimization of multiple responses is another highlight of this chapter. Desirability functions, unlike out-of-spec probabilities, do not require replicated runs or fitting of a variance model.

Chapter 10 describes the use of robust parameter design (see also Phadke 1989; Fowlkes and Creveling 1995). These designs are used to identify levels of control factors resulting in a system less sensitive to difficult-to-control sources of variation (noise). Two formats for parameter design experiments are discussed, cross arrays and single arrays. The authors provide guidelines, mainly based on run-size economy, for choosing one of these formats. Three strategies for analyzing cross arrays are discussed—location-dispersion modeling, response modeling, and use of the signal-to-noise ratio (S/N). Because S/N lacks physical justification in many situations, the authors counsel against using this metric. A useful collection of single-array designs is presented. Dynamic parameter design is covered in Chapter 11. These designs examine changes of response as a result of changes in a signal factor. Familiar examples of signal factors include pedal force for automobile braking, temperature settings for a thermostat, and amount of adjustment for controlling shower water temperature. The robustness of a signal–response relationship depends on levels of system control and noise factors. A useful application of dynamic parameter design is to improve the precision of measurement systems.

Chapter 12 discusses experiments for improving reliability using failure time data or degradation data (see also Meeker and Escobar 1998). A reliability experiment's response is the failure time of the unit under test. Since some units do not fail at the end of the experiment, the failure time is censored. As a result, standard regression techniques are not adequate so the authors discuss the use of maximum likelihood methods for point estimation and for assessing effect significance. A two-stage modeling and analysis strategy for analyzing degradation data is illustrated with an example involving the degradation of fluorescent lamps.

The last chapter covers nonnormal responses modeled by distributions such as the binomial, Poisson, gamma, and so forth. The authors describe the use of GLM to model these types of responses and the advantages of the GLM approach over response transformations. This chapter concludes with a discussion about the analysis of ordinal data using scoring. These scored responses can be analyzed using half-normal plots. However, the authors stress that analysis of ordinal data with either maximum likelihood or Bayesian methods results in higher inferential validity.

I found the Practical Summary at the end of each chapter to be a useful feature that can be a potential time saver. Here, the reader can review the highlights of each chapter and then study in detail any items of interest. At least one case study is highlighted at the beginning of Chapters 3–13 and is used to illustrate applications of various types of statistical designs. A total of 80 experiments based on actual case studies is described, 30 in the text itself and the others as exercises to which, unfortunately, no answers were provided.

I agree with the authors that this book is an excellent reference resource for experienced design-of-experiments practitioners. As the authors point out, this book is also suitable for advanced classes of students with many different science backgrounds. Many important concepts described in the recent literature are covered in sufficient detail to be of value to someone well versed in design of experiments. Should a reader want to learn more, an extensive list of references is provided at the end of each chapter. I was surprised, however, that no mention was made of mixture designs (see Cornell 1990), which are very useful in many industries where formulation work is conducted. This branch of designed experiments, unfortunately, has generally received scant coverage in textbooks. This book also made little mention of available statistical software packages. Although it is extremely important to understand the concepts behind statistical methods before using any software package, most problems and examples in this book are best analyzed with software, and much value would have been added had the authors shown a few examples of analysis with one or more statistical packages.

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Six Sigma: The Breakthrough Management Strategy Revolutionizing the World's Top Corporations, by Mikel Harry and Richard Schroeder, New York: Currency/ Doubleday, 2000, ISBN 0-385-49437-8, xii + 301 pp., $27.50.

Coauthored by one of the principal architects of the Six Sigma quality movement (Harry), *Six Sigma* provides a good nontechnical overview of the Six Sigma strategy directed toward business professionals. There are no references to technical journals or publications, only to business periodicals. Statisticians and quality and reliability engineering practitioners should not expect to find much in the way of technical details generally found in standard statistical quality publications. Missing are statistical formulas showing the functional relationship between outcome Y variables and input, independent X variables. According to Harry and Schroeder, the Six Sigma Breakthrough Strategy is a business initiative that uses financial measures to identify projects for improvement and to ascertain the results of those projects. Because of this business emphasis, traditional statistical displays were avoided so that the readers would not be "confused on how statistical tools apply to the real world" (p. 27).

Instead, this book is rich in case studies describing how Six Sigma has been successfully implemented and managed at such major corporations as Motorola, General Electric, AlliedSignal, and Polaroid. For example, case studies were presented of the GE Medical System's LightSpeed CT scanner, the strobe exposure accuracy of Polaroid's 600 Series camera line, and AlliedSignal's Six Sigma journey.

Harry and Schroeder point out that the role of statisticians and statistics needs to change. They cite the statistician's role as being able "to measure, improve, and monitor the process within our organizations. . . " Although statistics are used as the tools that separate "common sense from extraordinary reasoning . . . . Statistical knowledge is to the information and technological age what fossil fuel was to the industrial age. . . " (p. 24). The authors are critical of traditional statistical approaches because statistical approaches tend to be "a posterior" (after the fact). Responsible parties have to wait for outcomes to happen before improvement actions can take place. In this age when technological changes are happening every nanosecond, traditional statistical approaches need to be equally as fast.

Harry and Schroeder are certainly accurate in their assessment that many executives underestimate the Cost of Poor Quality (COPQ). If corporations do not replicate the same startling results for noteworthy Six Sigma cases, executives have a "tendency to discount what GE and others have done, or to minimize the importance of the lessons to be learned" (p. 30).

The authors also stress that managers not only need to "become more literate in statistics" but also to communicate statistical information "in a format that makes it usable, so people can extrapolate key data and apply it to their day-to-day work." Furthermore, "the full benefit of statistics can be achieved only in a culture that looks at data with the right skill—hence, the Breakthrough Strategy" (p. 25). Likewise, they admonish college and university professors to place more emphasis on using statistics to solve real-life problems. More specifically, university professionals need "to relearn the way they teach students so that when they enter the workforce they have the knowledge and skill to link theory to practice."

In the Six Sigma Breakthrough Strategy, Harry and Schroeder have packaged the ideas of leading business, statistical, quality, and engineering pioneers [W. E. Deming (1986), J. M. Juran (Juran and Godfrey, 1999), A. V. Feigenbaum, Philip Crosby, Genichi Taguchi, Dorian Shainin, Tom Peters, Michael Hammer, James Champy, Lloyd Nelson, and Steven Covey] in a way that makes them palatable to senior executives. Perhaps the only weakness of this book is that the authors should have given more credit to those pioneers who created the original concepts.

This book is worthwhile for statisticians and quality professionals because it forces us to adopt a more business-minded and financially accountable paradigm in analyzing data. The authors offer useful guidelines for selecting, prioritizing, and screening projects and describe the necessary conditions for creating the infrastructure that helps prepare organizations to achieve Six Sigma quality levels. Harry and Schroeder have offered a wake-up call to statisticians to use statistical approaches that are faster, communicated in a more understandable format, and more directly applicable to the workplace and everyday life.

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Juran, J. M., and Godfrey, A. B. (1999), *Juran's Quality Handbook* (5th ed.), New York: McGraw-Hill.

Root Cause Analysis, by Bjorn Andersen and Tom Fagerhaug, Milwaukee: ASQ Quality Press, 2000, ISBN 0-87389-466-9, x + 155 pp., $30.

The stated aim of this book is to "make the art of root cause analysis more accessible to the larger audience." In this, the book is highly successful. I have never seen a better reference for basic problem-analysis techniques than this book provides. The authors have done an excellent job bringing together various techniques for prioritizing problems, generating possible causes, and analyzing to get to the root causes. It must be emphasized that these techniques are for the most part qualitative methods for narrowing business problems down to a root cause or causes—you will not find anything more mathematically complex than a histogram here. What you will find is a well-laid-out, easy-to-follow reference that guides you through the process of understanding a problem and explains each step of the way.

The authors' target audience is the business professional or manager at a business in which more advanced problem-solving techniques (such as Six Sigma) are not routinely used. The techniques (or "tools" as they are referred to) presented are simple, easy to understand, and easy to do, and they do not require previous training. Thus, the book would make an excellent reference for workers on problem-solving teams. It would also make a good training tool for worker problem-solving teams.

The book is well designed for ease of use. The authors break the overall subject of root cause analysis into easily understood components: problem understanding, possible cause generation and consensus reaching, problem and cause data generation, possible cause analysis, and cause-and-effect analysis. Each component is further broken down into individual techniques or tools. Under problem understanding, for example, the authors have listed flowcharts, the critical incident method, spider charts, and the performance matrix as tools. The basic purpose and application of each tool is explained, examples are given, a checklist is given that details the steps for using the tool, and, where appropriate, templates are given for making charts.

Every page of the book has a navigation aid on the outside margin, which lets the user know where in the process the particular tool being discussed fits. The same format is followed for every tool—purpose and application, a hint or tip for use, a list of steps for use, an example, a checklist, and a template if applicable. Key concepts are generally on the top half of the page, examples and application tips on the bottom half. The font used is large and easy on the eyes, and diagrams are large, bold, and simple. A set of flowcharts is presented that leads the user through a structured decision-making process of deciding which method to use in certain situations.

All that having been said, it must be understood what is *not* found in this book. If you are looking for detailed explanations of the techniques, go elsewhere. If you want to know the theory and mathematics behind the techniques, you are out of luck. Do not look for complex examples. Do not expect to learn some fancy new statistical analysis techniques. What you get is a very brief (usually half a page) explanation of the technique in bulletized presentation format. Examples tend to be somewhat simplistic and service oriented rather than manufacturing oriented. Techniques presented are mostly the most basic nonstatistical tools for discovery and analysis of business problems—the most complex math in the book is that needed to calculate a histogram.

Unless you work in a place where Six Sigma or other advanced problem-analysis techniques have been applied to the business problems, you will find this book useful. These techniques are excellent for plucking the low-hanging fruit—the basic problems found in processes that have not had a lot of formal application of quality-analysis techniques (not under statistical control, capability not statistically understood, perhaps not even having a measure of quality in place). These techniques assume, for the most part, that the problems are simple in nature and that the people who do the work probably know what the problems are. You will not find any information on actually fixing the problems—this book stops at finding the root causes.

A business that is looking to improve quality and that has not applied problem-solving techniques to its processes will save much money by getting this book and applying its techniques. It would make an excellent reference for problem-solving teams to follow, for trainers of the problem-solving teams to train by, and for quality professionals or managers to use to guide problem-solving efforts and track results. By using these techniques, measures of process quality will be developed, which is the most basic first step that needs to be taken to improve quality. Businesses that have already applied more advanced techniques, or that have developed their own internal structured problem-solving methods, should probably pass (unless a "basic training" reference to be supplemented by other material is desired). Although many readers will find this book overly simplistic, it could be the ticket to better quality and thus better business performance for many smaller businesses that do not have formal problem-solving methods in place. You must start somewhere to improve quality—this is a good place to start.

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Normality and the Process Behavior Chart, by Donald J. Wheeler, Knoxville, TN: SPC Press, Inc., 2000, ISBN 0-945320-56-6, vi+149 pp., $20.

The author has for quite some time been espousing the idea that control charts for individuals can be applied successfully regardless of the underlying distribution (e.g., see Wheeler 1991). The main purpose of this book appears to be further justification of the statement "The normality of the data is neither a prerequisite for a process behavior chart, nor an inevitable consequence of a predictable process," which is found in between the table of contents and Chapter 1 and as the last sentence in the last chapter. For "process behavior chart," one should read "control chart," and it is actually the first half of the statement that this book is addressing.

One is first treated to an interesting, but fairly lengthy (15 pages), history of the normal distribution. This is followed by an even lengthier (20 pages) discussion showing that a χ^2 goodness-of-fit test cannot be used to ascertain if a set of data looks normal in the tails. Although this is certainly true, the implication that one cannot check normality in the tails is not.

In the middle of the book is a nice, very elementary discussion of Shewhart $\overline{X}$ and R charts (16 pages). The remainder of the book consists of various arguments as to why normality is not a prerequisite for these charts, even when one is using charts for individual values. Although I agree with Shewhart (1931) that "in almost all cases in practice we may establish sampling limits for averages of samples of four or more on the basis of normal theory" (see Schilling and Nelson 1976), I was unconvinced by any of the arguments presented in this book that one can use charts for individuals without any idea of the underlying distribution.

The main arguments seem to be that (1) the control chart constants d_2 and d_3 do not change much as the underlying distribution changes, (2) what appear to be big differences when one looks at average run lengths (ARL's) does not really matter because the ARL is not the correct way to compare, and (3) with the usual sample sizes the variation in ARL for a normally distributed process is so great that it encompasses the ARL's for essentially all other processes.

It is assumed that estimates of variability for an $\overline{X}$ chart will be based on the subgroup ranges and hence all the discussion is in terms of d_2 values. The "effective degrees of freedom" for $\overline{R}$ is related to the coefficient of variation (CV) for $\overline{R}$, and all discussions of variability are done in terms of the CV. As an aside, the fact that the effective degrees of freedom for $\overline{R}$ are at best only 90% of what they would be for s^2 (or s) seems to be a compelling reason for not using $\overline{R}$, whereas the fact that s^2 used to be more difficult to compute is no longer a reason for considering $\overline{R}$.

The discussion of d_2 values uses the results of Burr (1967) in which d_2 values were computed for a variety of differently shaped distributions. Using a pseudo-Bayesian approach the author obtains a CV for d_2 and attempts to combine the CV's for $\overline{R}$ and d_2 to see how different d_2 values affect the variability of $\overline{R}/d_2$. His claim is that, "ignoring the effects of correlation," one obtains $CV(\overline{R}/d_2) \doteq \sqrt{[CV(\overline{R})]^2 + [CV(d_2)]^2}$. I am unable to justify this statement. We are also told that the CV is "not affected by linear transformations," which is clearly false.

The argument that the ARL is not an appropriate comparison reverts to the idea that all inference from data is done with histograms, and histograms provide little information on the behavior of a distribution's tails. We are also told (p. 93), "Since any probability model is, of necessity, a limiting characteristic for an infinite sequence of values, it therefore cannot be characteristic of any finite portion of that sequence." Even if one were to accept this statement, it is unclear to me why it should apply to the ARL but not to the probability of coverage for three-sigma limits, which the author has provided for 1,143 distributions (30 pages worth).

The third argument constructs an interval of possible values for the ARL of a normally distributed process based on the variability of $\overline{R}$ and notes that the ARL's for a variety of other distributions fall within the interval. It seems to me a better comparison would be to compute intervals for the ARL's of all the distributions and compare the extent of overlap, or even better, compare the distributions of runs lengths.

I am not sure what audience the author had in mind when he wrote this book, but I doubt many of the readers of *Technometrics* would find much in it of interest.

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Statistical Methods for the Reliability of Repairable Systems, by Steven E. Rigdon and Asit P. Basu, New York: Wiley, 2000, ISBN 0-471-34941-0, xii + 281 pp., $84.95.

This is a user's book review. This book did not initially impress me at all because of its heavily mathematical front-end load. However, the first reviewer volunteer returned the book simultaneously with my getting involved with the modeling of the lifetime of a pumping system on the Alaska north slope. Previously I had modeled lifetimes for one system component, the submersible pumps in the wells. These pumps were nonrepairable. The engineer subsequently decided to study the pumping system for each of the wells as a repairable system. The authors of this book have correctly (based on my hasty research work) noted in their Preface (p. xi) that most reliability books, such as the excellent recent book by Meeker and Escobar (1998), reviewed by Nelson (1998), primarily deal with nonrepairable systems. This new book does a fantastic job of giving detailed coverage and practical illustration to repairable systems reliability at a level that narrow-minded industrial statisticians and their engineering colleagues can readily comprehend.

My initial negative reaction came from the definition–theorem–proof structure of the two methodology-development chapters. Following some excellent motivation in the introductory sections, the rest of the first chapter dives right into the proof format, which I always find to be worthy of disdain. However, ignoring all that, one initially finds a very carefully explained introduction to reliability concepts and distributions that will not overwhelm even a statistically timid engineer. Subsequently, however, this approach bogs down when it outlines the basic theory of point processes. That reduced my reading to trying to understand definitions and theorems, skipping proofs, and dwelling on the brief verbal and mostly heuristic explanations that the authors helpfully provided between their mathematical evocations.

In Chapter 2, "Probabilistic Models: The Poisson Process," and Chapter 3, "Probabilistic Models: Renewal and Other Processes," the definitions become more mathematically obtuse and the proofs to the theorems get much longer. Proving that the number of failures in an interval is a random variable having a Poisson distribution, given four minimal assumptions, takes six pages! It all makes for some fairly quick reading when you skip the proofs! There are, in addition to the simple explanations around the proofs, some elementary examples that keep one from getting totally overwhelmed. I certainly would have liked more of both of these types of links to reality. By the time one gets through the first section of Chapter 3, 32 definitions, 29 theorems, 27 lemmas, and 20 corollaries have been encountered. This much reading carries one through the introduction to renewal processes. The content for the remaining four sections of Chapter 3, which is piecewise exponential models, modulated processes, branching Poisson processes, and imperfect repair models, is presented through description and discussion, though there remains some significant mathematical content.

If one were despairing somewhat of ever making any sense of these models, that perspective quickly disappears when one reaches Chapter 4. Titled "Analyzing Data From a Single Repairable System," it immediately dives into graphical methods that will convince the practitioner that all is not lost. These methods for examining failure times and the nonparametric methods for estimating rates of occurrences of failures, which follow in the next section, are readily programmable in S-PLUS or SAS. There are excellent examples from sources such as Hand and Crowder (1996), reported by Ziegel (1997), to illustrate each of the procedures. There follow pairs of sections on testing and inference, respectively, applied to the homogeneous Poisson process and the power law process. Despite the somewhat overwhelming methodology development in Chapters 2 and 3, the material here is again readily comprehensible, even for an industrial statistician. It too often is all handily supported by straightforward programs written in S-PLUS or SAS. No direct software application is made. The latter part of the chapter has a long section on Bayesian estimation. This actually starts at the beginning of the Bayesian world with the usual definitions and formulas. Bayesian results are shown for both HPP and power law models, including nice illustrations on expected future failures. There is some derivation. Thereafter models and methodology get more complicated—modulated power law processes, piecewise exponential models. The lengthy chapter concludes with a couple of sections on standards.

The final chapter deals with multiple repairable systems, such as considering all of BP's Alaska oil wells in one field as a unit. Several types of systems are discussed—all systems with identical homogeneous Poisson process models, systems with nonidentical homogeneous Poisson processes, systems with parametric empirical Bayes and hierarchical Bayes models for the homogeneous Poisson process, power law processes for identical systems, power law processes for nonidentical systems, systems with parametric empirical Bayes models for the power law process. Methodology gets a little heavy again, particularly for the Bayesian methods. There are excellent illustrations for all of the sections. The book concludes with 50 pages of tables and references.

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Statistical Procedures for Machine and Process Qualification, by Edgar Dietrich and Alfred Schulze, Milwaukee: ASQ Quality Press, 1999, ISBN 0-87389-447-2, xix + 396 pp., $56.25.

The authors state in their Preface that "this book describes the statistical methods and procedure required for machine and process qualification." They go on to say that this book primarily focuses on DIN ISO requirements, and that the "nomenclature is based on definitions taken from norms or set by the DGQ (German Society for Quality)." This is an excellent book on performing gauge capability studies for a wide variety of underlying statistical distributions. Statisticians will find it of particular interest; the book should be more appealing to them than to quality practitioners.

The book consists of eight chapters and an appendix. The chapters are organized as follows:

1. Introduction
2. Introduction to Engineering Statistics
3. Control Charting
4. Assessment Criteria for Selection of a Distribution Model
5. Procedures for Process Assessment
6. Process Capability Indices
7. Building a Qualification System
8. Measurement System Capability

   Appendix
   Tables
   Ford Test Examples

In Chapter 1, the authors present a nice discussion on the use and benefits of statistical process control. The relationship of Taguchi's loss model to the principle of continuous quality improvement is also discussed, as well as the application of different types of process models to a given production process. The process models serve to illustrate that the theory proposed by Shewhart does not necessarily apply to a realistic description of the process data over time. The authors propose applying statistics to the assessment of a machine or process according to what they refer to as the "stages of assessment." According to them this chapter concerns the question, "Why should statistical methods be used?" The chapter does not dispute the use of statistics, but rather offers advice on how and which methods to use. Chapter 2 gives an introduction to engineering statistics and covers both discrete and continuous distributions. The chapter is well written and attempts to illustrate the relationship among the most commonly used discrete and parametric (continuous) distributions (Fig. 2.1-3, p. 22), but its depth will most likely intimidate the more statistically timid practitioners. In Chapter 3, the authors discuss the use and construction of control charts for both discrete and continuous data. All of the more conventional control charts are discussed, and operating characteristic curves are discussed to illustrate the sensitivity of a control chart to a change in the process.

In Chapter 4, we are introduced to the assessment criteria for selecting a distribution model. The authors correctly assert that "the first rule in selecting a distribution model should be *no assessment without technical knowledge*." Using a first-principles approach to the process should often suggest an appropriate distribution to look for. Several common (and not so common) distributions are illustrated and related to the process model types discussed in Chapter 1 (Table 4.1-1, p. 196). The distribution fits rely heavily on regression methods, histograms, and probability plots that offer a nice graphical approach. Chapter 5 covers procedures for process assessment. All assessments follow a common procedure (Fig. 5.1-1, p. 207):

1. Collecting measurement values from the process (assuming a capable measurement system)
2. Grouping of the values into samples (subgroups) of size n
3. Calculating the subgroup statistics—for example, mean, standard deviation
4. Plotting the subgroup statistics for each subgroup on the corresponding control chart
5. Calculating the control limits after 20 subgroups and plotting them on the control charts
6. Assessing the process stability according to the guidelines for control charts

Procedures are discussed for each of the process models covered in Chapter 1. The chapter ends with a discussion of the "time sequence of capability studies," which leads into Chapter 6 on process capability indices.

In Chapter 6, the authors present an introduction to the calculation of process capability indices. Quality practitioners may find that "preliminary process capability studies" is another term for the determination of process *performance* (as discussed in most books on this subject). In particular, the use of C_m, P_p, and C_p are for determining process potential for a machine capability, a preliminary process, and an ongoing process capability study, respectively. On the other hand, the use of C_{mk}, P_{pk}, and C_{pk} are for determining process capability for a machine, a preliminary process, and an ongoing process, respectively. Index calculations for nonnormal distributions are also discussed. In Chapter 7, the objective of building a qualification system is considered. The question of "what is a machine or process qualification?" is discussed so that the reader understands what details are involved. The rationale for why we need machine and process assessments is also given. A few sections follow that discuss the flow of information from measuring stations. A case study on the acceptance of a machine tool is given at the end of the chapter to illustrate the implementation of a machine capability study. Chapter 8 presents a discussion of measurement system capability. Those readers who are not familiar with the procedure for implementing a gauge capability study will find this chapter to be a good introduction to the subject. The authors present procedures for three types of measurement studies. Readers will recognize that the Type 2 and 3 studies are variations of a standard R&R study approach. The chapter ends with some frequently asked questions about measurement system capability.

In the Appendix, the authors give a shameless plug for the Q-DAS software that was used to generate most (if not all) of the graphical analysis in the text. The software looks good, but there are many statistical programs that offer the same analyses. The Appendix also contains a discussion of analysis of variance as applied to the three types of measurement studies covered in Chapter 8. Formulas for the probability distribution functions (pdf's) and cumulative distribution functions (cdf's) of the distributions discussed in the text are given at the end of the Appendix. The only complaint that the reader may have with this book is its dependence on German standards. Most readers will be more familiar with the ISO, ANSI, or ASTM E-11 standards than the DIN standards for performing capability studies for machines and processes. The QS-9000 standard is briefly mentioned, but the authors could better serve their readers by offering a set of comparable (or equivalent) international or U.S. standards that may be more accessible to them. For example, ASTM and ASQ (American Society for Quality) offer standards that can be obtained via their Internet Web sites.

In conclusion, I found this book to be a comprehensive discussion of methods that can be used to perform both machine and process capability studies. The approach of extending these ideas to the concept of machine and process qualification is intuitive, and readers, particularly statisticians, should find this book to be a worthwhile addition to their libraries.

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Corning Incorporated

The Practice of Statistics: Putting the Pieces Together, by John D. Spurrier, Pacific Grove, CA: Brooks/Cole, 2000, ISBN 0-534-36490-X, xiv + 202 pp., $37.95.

The purpose of this book is to synthesize the several disciplines (computing, mathematics, and statistics) in a statistics major curriculum and to add the nonstatistical skills (effective report writing and oral presentations) that a practicing statistician may need. To achieve this purpose, the author provides very well-written unified accounts of 11 capstone experiences that simulate the types of problems that statisticians might encounter early in their professional careers. The book is arranged into two parts—Part I, which contains the capstone experiences, and Part II, which contains the nonstatistical skills.

Part I includes Chapters 1–11, in which the author tries to put the pieces together by presenting the 11 capstone experiences that simulate the types of problems that statisticians might encounter early in their professional careers. These chapters are presented in a unified format that includes introduction, computing concepts and procedures, mathematical concepts, statistical concepts, and materials required. Chapter 1 discusses the steps (such as coding, data entry, and checking) needed to prepare data for statistical analysis. Chapter 2 deals with designing a telephone survey. Chapters 3–11 include the data-analysis part, providing appropriate statistical solutions to selected practical problems. These problems include topics on sample size determination, linear regression, variance component estimation, classification and discriminant analysis, response surface optimization, logistic regression, and Bayesian estimation.

Part II includes Chapters 12–16, in which the author details strategies for sharpening the nonstatistical skills for effective written and oral communications. Chapters 12 and 13 present strategies for effective report writing and oral presentations. Chapter 14 gives a few hints on the use of PowerPoint to create professional visual aids. Chapter 15 hints on strategies for statistical consultants, and Chapter 16 provides strategies for job searching.

It is worthwhile to highlight some of the merits of this book. Each chapter opens with a motivation, and it places the reader into a real-life setting of the problem being investigated. Discussions of computational aspects using SAS are included wherever appropriate. The capstone experiences are real and interesting although most are restricted to engineering and science applications. Individual and teamwork exercises are abundant in each chapter. The book not only enriches the practical experience of students majoring in statistics but it also enhances their comprehension of the subject matter.

The author suggests the following three approaches for using the book: a three-semester-hour stand-alone course, a complementary book to other courses (sampling, experimental design, etc) in the curriculum, a one-semester-hour course that includes selecting five of the capstone experiences of Part I in addition to the nonstatistical skills of Part II of the book. As I see it, the students must have a senior or a graduate standing in statistics to understand the book.

I would like to bring forward the following constructive criticism:

1. The book author does not provide references on the subject-matter chapters (Chaps. 3–11). Readers may want to refresh their memories or read more about sample size determination, experimental design, and so forth. I believe it would be valuable to include one or two basic reference books in each chapter.
2. Chapter 12, "Strategies for Effective Written Reports," needs to include illustrative specific examples and exhibits on how to report statistical results and graphics. This chapter is most crucial because inability to report statistical analyses and results in writing is a deficiency that most students have. I would recommend that one complete sample report on one of the capstone experiences (discussed earlier in the book) be added as an appendix to the book. This will indeed show the students how to put the pieces together into one final report and thus satisfy the main objective of the book.

Overall, the book was very well written, and I do recommend it to serve as a reference and/or a complementary textbook for statistics majors.

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Data Analysis by Resampling: Concepts and Applications, by Clifford E. Lunneborg, Pacific Grove, CA: Brooks/Cole, 2000, ISBN 0-534-22110-6, xvii + 568 pp., $83.95.

Data Analysis by Resampling: Concepts and Applications attempts to fill a gap left by many of the early books on bootstrapping and resampling. Unlike the books by Efron and Tibshirani (1993) and Davidson and Hinkley (1997), it seeks to provide an introductory view of resampling methods at a level accessible to advanced undergraduates and nonstatistical researchers, claiming only a first course in statistics as a prerequisite. Indeed, a reader with a college algebra background is well equipped to handle what little mathematical detail is given.

The five stated goals of the book are to (1) establish the importance of matching the data analysis to the sampling design, sample size, known assumptions, and questions asked; (2) introduce different sampling approaches; (3) demonstrate their use in a variety of problems; (4) provide algorithms for their computation; and (5) illustrate their use with statistical packages. The body of the book is explicitly arranged to remain true to these goals, with a special emphasis on the first. Very careful and structured approaches to resampling are given, guided by a flowchart, to direct the selection of resampling methods that match the sample design. In particular, *bootstrap* resampling is reserved explicitly for those situations in which a *random* sample has been chosen from a clearly defined population (which occurs far less frequently than most of us would like to think). Standard errors and confidence intervals are computed in these situations, and hypothesis tests are carried out by inverting the interpretation of the confidence interval. *Rerandomization* analysis is used only to carry out tests in studies involving random assignment of treatments to a nonrandom set of available cases. Finally, subsampling is used to subjectively examine the stability of descriptive statistics in studies that lack randomization completely.

The book is laid out in an easy-to-read fashion. There are 16 "Concepts" chapters, each of which is roughly equivalent to a single lecture on a single topic or on a set of closely related topics. Each Concept is followed by an "Application" typically involving a real dataset. Chapters 17–23 provide details on application of the various methods to specific classes of problems (e.g., k-sample, regression, and categorical). Each of these latter chapters gives examples using each different form of resampling as well as a standard parametric analysis.

Despite a lighter level of reading than some books on resampling, *Data Analysis by Resampling* does not sacrifice technical accuracy. For example, confidence intervals are routinely computed using the bias-corrected and accelerated method, rather than the simpler, but less accurate, percentile method. The care with which populations, samples, and inferences are described and related to one another and to the different resampling methods is also notable. This is especially useful for the book's target audience, for whom such concepts may not yet have taken root.

On the computational side, the book may be a little less satisfying. Step-by-step computational algorithms are at some times inefficient and at other times cryptic so that an individual with little programming experience might have difficulty applying them. This problem is substantially offset by the presence of numerous detailed examples solved using existing software, providing readers roughly equal exposure to S-PLUS, SC, and Resampling Stats. Unfortunately, these examples often require large, complex programs, demonstrating as much as anything a need for better resampling software.

On the whole, *Data Analysis by Resampling* is a useful and clear introduction to resampling. It would make an ambitious second course in statistics or a good third or later course. It is quite well suited for self-study by an individual with just a few previous statistics courses. Although it would be miscast as a graduate-level textbook or as a research reference—for one thing it lacks a thorough bibliography to make up for its surface treatment of many of the topics it covers—it is a very nice book for any reader seeking an introductory book on resampling.

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Handbook of Parametric and Nonparametric Statistical Procedures, (2nd ed.), by David J. Sheskin, Boca Raton, FL: Chapman & Hall/CRC, 2000, ISBN 1-58488-133-X, xxix + 982 pp., $119.95.

This is a handbook for using parametric and nonparamteric statistics and is designed for students, teachers, and consultants from different disciplines. This book consists of more than 900 pages, containing an introduction, 32 tests, and 23 tables. As did its earlier version, the book has its unique organizational features that are different from other books. It introduces the definition of statistics, type of variables, measures of variability, type of distribution, hypotheses testing, appropriate statistical procedure, and inferences. Many equations are also presented in the introduction. It also provides the basic concepts in experimental design, correlation, and parametric and nonparametric inferential statistics. Then it introduces four tables that guide the user to the right statistical procedure based on the type of data in hand and the statistical procedure that is needed. These tables are called Guideline and Decision Tables. The introduction and the decision tables are a perfect guide to understanding and choosing the appropriate statistical test. One difference between this edition and the first is that this edition introduces excellent discussions in bootstrap and jackknife techniques with examples that are easy to understand and apply.

Each test chapter consists of many sections starting with the hypothesis, introduction, and description of the test statistic. There are many examples in each chapter showing the application of a test. Test chapters are grouped into seven sections based on specific inferences and usage. The addendum and endnote, are further discussions about special issues that relate to that chapter, including a statistical test accompanied with the necessary mathematical derivations. A clear guide for use in applying inferential and descriptive statistics is given. I shall summarize the content of each test chapter and conclude with some general observations.

Section 1 is about inferential statistical tests for a single sample and contains 10 tests—for comparison of means, Z test, t test, Cohen's d test, and the chi-squared test for population variance; for population skewness, kurtosis, Wilcoxon signed-rank test, Kolmogorov–Smirnov goodness-of-fit test, chi-squared goodness-of-fit test, binomial sign test, single-sample runs, and other tests for randomness.

Section 2 is about inferential statistical tests for two independent samples (and related measures of association/correlation) and contains six tests (test 11–test 16)—t test, z test, Mann–Whitney U test, the Kolmogorov–Smirnov test, the Siegel–Tukey test for equal variability, the Moses test for equal variability, the chi-squared test for homogeneity, and the chi-squared for independence. Good discussions on statistical significance ("significant differences between means") and practical significance ("practical implication of the obtained results") were introduced in the addendum (p. 263) as well as in the introduction, two independent samples, meta-analyses, and related topics.

Section 3 is about inferential tests for two dependent samples (as related measures of association/correlation) (test 17–test 20)—t test, z test, Wilcoxon matched-pairs signed-ranks test, the binomial sign test for two dependent samples, the McNemar test, and the Bowker test for normality. There is a discussion (in this section and others) of using correction for continuity for the normal distribution when continuous distribution is used in a nonparametric method to estimate a discrete distribution.

Section 4 is about inference tests employed with two or more independent samples (and related measures of association/correlation) (test 21–test 23)—single-factor between-subject analysis of variance (ANOVA), the single-factor between-subjects analysis of covariance, Kruskal–Wallis one-way ANOVA by ranks, and the Van der Waerden normal-scores test for k independent samples. A discussion of the values of F and t asks whether a significant difference exists between the treatments means but does not provide more information that relates to the size of treatment effect—that is, the proportion of the variability on the dependent variable that is associated with independent variable/experiment treatment. However, omega^2, eta^2, and the Cohen f index values can be used as a measures of treatment size and effect, association, and correlation coefficients

Section 5 is about the statistical tests employed with two or more dependent samples and related measures of association/correlation (test 24–test 26)—single-factor within-subject analysis of variance, the Friedman two-way ANOVA by ranks, and the Cochran Q test.

Section 6 covers tests employed with factorial design (and related measures of association/correlation) (test 27)—the between-subject factorial ANOVA and Cohen's f index; there is more discussion of the between-subjects factorial ANOVA and the factorial ANOVA for a mixed design and within-subject factorial ANOVA.

Section 7 discusses measures of association/correlation (test 28–test 32)—the Pearson product-moment correlation coefficient test, evaluating the hypothesis that the true population correlation is a specific value other than 0. It presents Spearman's rank-correlation coefficient, Kendall's tau, Kendall's coefficient of concordance, and Goodman and Kruskal's gamma as measures of associations.

Several essential issues are discussed in the book, and I would like to highlight some of them. There is a nice discussion throughout the book about an important issue—"significance"—and how to justify reporting nonsignificant results although it is not popular when publishing a research article. If the differences between treatments were not significant, a researcher should pursue further analyses such as differences in variance and degree of association between dependent and independent variables (e.g., ω^2). Excellent information is given about violating one or more assumptions of a parametric test in using the t test (p. 269) and how the t test is called a robust test and information is lost when nonparametric tests are used. A wonderful discussion is given on comparing results from parametric and nonparametric tests along with significant levels (top p. 270). The justification of including or excluding outliers and how to overcome this problem are discussed. One way is through accommodation of most commonly used data transformations and use of a simple guideline based on level of proportionality of variance and mean values to decide which data transformation to be used. There is a wonderful discussion on odd ratio and multidimensional contingency tables and planned and unplanned comparison in the ANOVA.

As a researcher and professor, I found that this book lays down clearly the basic foundation behind any statistical analyses by providing clearly the guidance to choose the right statistical method. The most intriguing part is how and when to choose between parametric and nonparametric analyses. Often, results from both analyses are similar; this observation may be documented in a few papers but is rarely cited in a textbook where the information is most accessible by many (p. 34, L17–19). I strongly recommend this book for students who are taking statistics classes. To overcome the high cost that may prevent students from owning one, I suggest that it be used at different levels for statistics classes, which will reduce the cost burden on the students.

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Linear Mixed Models for Longitudinal Data, by Geert Verbeke and Geert Molenberghs, New York: Springer-Verlag, 2000, ISBN 0-387-95027-3, xxii + 568, $79.95.

Mixed-effects models (or mixed models) provide a flexible and powerful tool for the analysis of data with a complex variance structure, such as correlated data. Linear mixed models originated specifically in the area of application. The motivation of this book is to satisfy the great demand by users from various applied backgrounds for clearer guidance on using the available methodology (e.g., theoretical concepts and their software implementation) more effectively. The authors refer to this book as a *second version* of their first book *Linear Mixed Models in Practice* (Verbeke and Molenberghs 1997). This book, however, is not presented as a second edition since a large range of new topics has been added and material kept from the first version has been reworked. The authors adopt the view that each type of outcome should be analyzed using instruments that exploit the nature of the data (i.e., each model family requires its own specific software tools). This book provides a comprehensive treatment of linear mixed models for continuous longitudinal data. Over 125 illustrations are included in the book.

This book gives emphasis to practice rather than mathematical rigor. Although enough theory is covered in the text to understand the strengths and weaknesses of mixed models, the authors emphasize the applied aspects of these. Hence, this book is explanatory rather than research oriented. It is mentioned that the authors attempt to target applied statisticians and biomedical researchers in industry, public health organizations, contract research organizations, and academia. I do believe that the book may serve as a useful reference to a broader audience (e.g., researchers in reliability engineering). Since practical examples are provided as well as discussion of the leading software utilization, it may also be appropriate as a textbook in an advanced undergraduate-level or a graduate-level course in an applied statistics program.

This book is organized into 24 chapters. Excluding the first two and the last two chapters, it may also be divided into two parts. In the first part, comprising Chapters 3–13, emphasis is on the formulation and the fitting of, as well as on inference and diagnostics for, mixed models in general. In the second part, comprising Chapters 14–22, the problem of missing data is discussed in full detail, with emphasis on how to obtain valid inferences from observed longitudinal data and how to perform sensitivity analyses with respect to assumptions made about the dropout process. A more detailed structure follows. Chapter 1 introduces the scope, while Chapter 2 presents the examples used throughout the book. Chapters 3–9 provide the core about the linear mixed model. Chapters 10–13 discuss extensions to the original model and more advanced tools for model exploration and influence diagnostics. Chapters 14–16 introduce the reader to basic incomplete longitudinal data concepts, such as *dropout*, which refers to the case in which all observations on a subject are obtained until a certain point in time. Chapters 17 and 18 discuss strategies to model incomplete longitudinal data, based on the linear mixed model. The sensitivity of such strategies to parametric assumptions is investigated in Chapters 19 and 20 (more technical material is deferred until Appendix B). Some additional missing data topics are presented in Chapters 21 and 22. Chapter 23 is devoted to design considerations, such as designing experiments with minimal risk of high losses in efficiency due to dropout. Building on the methodology developed in the book, Chapter 24 presents five case studies. Appendix A reviews a number of software tools for fitting mixed models.

The balanced mix of real data examples, modeling software, and theory makes this book a useful reference for practitioners using mixed models in their data analysis. Researchers will also find this book appealing for its extensive literature review, for the presentation of novel methodologies, and for its discussion about needed research. In this topic (e.g., p. 237: specialized software for fitting nonrandom dropout models; p. 296: methods that investigate the sensitivity of the results with respect to the model assumptions; p. 374: other sensitivity analysis approaches in the pattern-mixture content).

It is mentioned in the Preface that selected macros (and programs) for tools discussed in the text, as well as publicly available datasets, can be found at Springer-Verlag's URL: *http://www.springer-ny.com/*. The given URL is too general, and it took some time to access the information for this book. A more efficient approach is referring the reader to the following URL: *http://www.luc.ac.be/censtat/members/geertmpub.html*, where the datasets can be found. At this same site, macros, errata, and updates of the materials in the book should be made available.

Adding the following to the Preface would have been useful to the prospective reader: prerequisites for the technical material in the book, recommended outlines for undergraduate- and graduate-level courses, and typographical conventions. Some minimum prerequisites for the technical material in the book, in my opinion, include a knowledge of calculus and linear algebra and a working knowledge of probability and statistics such as provided in advanced undergraduate or graduate courses in statistics, mathematics, and related fields. Some knowledge of the SAS language is definitely desirable but not a prerequisite for following the material in the book.

Great care has been taken in presenting the data analyses in a software-independent fashion. The format of this book consists of (1) presenting a research question, (2) translating it into a statistical model by means of algebraic notation, and (3) implementing such a model (for most cases) using a SAS code. Although most analyses were done with the MIXED procedure of the SAS software package (discussed in detail in Chap. 8), some other commercially available packages are discussed as well. Appendix A.3, for example, describes the built-in function *lme*() for analyzing linear mixed models in S and S-PLUS. (The companion function for nonlinear mixed models, *nlme*(), is also mentioned.) On pages 493–494, the reader should not be confused with *mle*() and *nmle*(), which should have read *lme*() and *nlme*(), respectively.

In summary, the increasing popularity of mixed models is explained by the flexibility they offer in modeling complex data, by the handling of balanced and unbalanced data in a unified framework, and by the availability of reliable and efficient software for fitting them. This book provides an overview of the theory and application of linear mixed models in the analysis of correlated data. The scope of this book is restricted to linear mixed models for continuous outcomes. This book provides guidance on using the available methodology more effectively to practitioners from a wide variety of areas. Because of its discussion and detailed reviews, advanced students and researchers may benefit from it as well.

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A Casebook for Spatial Statistical Data Analysis, by Daniel A. Griffith and Larry J. Layne, New York: Oxford University Press, 1999, ISBN 0-19-510958-9, xviii + 506 pp., $55.

Since I am currently teaching an applied spatial statistics class, this book seemed to be a highly welcome addition that could provide useful examples and case studies for my class. However, after a few hours of reading, this book ended up on my shelf and has not been used at all for my spatial statistics class.

The book seems to be highly appealing when looking only at the table of contents, which promises a large number of analyses of georeferenced data from different fields. Overall, the book consists of 3 parts and 10 chapters, which are as follows:

Part I: Theoretical Background

1. Introduction
2. Important Modeling Assumptions
3. Popular Spatial Autoregressive and Geostatistical Models

Part II: Georeferenced Data Set Case Studies

4. Analysis of Georeferenced Socioeconomic Attribute Variables
5. Analysis of Georeferenced Natural Resources Attribute Variables
6. Analysis of Georeferenced Agricultural Yield Variables
7. Analysis of Georeferenced Pollution Variables
8. Analysis of Georeferenced Epidemiological Variables

Part III: Visualizing What Is Not Observed

9. Exploding Georeferenced Data When Maps Have Holes or Gaps: Estimating Missing Data Values and Kriging
10. Concluding Comments

Unfortunately, for practical purposes such as an add-on to a spatial statistics class, the book is not very suitable. Here are some of its major drawbacks:

First, the overall visual appearance is not very appealing. In particular, the printing of many of the graphics is extremely poor; for example, labels are unreadable, lines partially disappear, circles are almost invisible, legends are indistinguishable, and so on. Worst cases can be found on pages 97, 101–102, 254, 265, 310, and 361, to mention only a few. It could be that several graphics have been scanned in at a low resolution or simply have been copied from another publication. How else to explain the vertical line between Figure 2.12(a) and (b) on page 104 [not to mention that Figure 2.12(b) has been properly labeled but certainly shows the same data as Figure 2.12(a) and not a residual plot]. Important references are missing or outdated. For example, the authors speak of software for spatial statistical analyses on page ix in the Preface and on page 39; for example, VARIOWIN and the "S+ spatial statistics module" are listed. However, the references one would expect do not show up anywhere in the book—that is, Pannatier (1996) for VARIOWIN and Kaluzny, Vega, Cardoso, and Shelly (1998) for S+SpatialStats. Outdated first editions—for example, Cressie (1991) and Venables and Ripley (1994)—are listed in the references although major updates did exist prior to the publication of this book—that is, Cressie (1993) and Venables and Ripley (1997).

The most exciting part of the book seems to be the datasets. In the preface (p. viii), the authors state, "The data sets analyzed in this book comprise readily available ones (35), some of our own (3), and some unpublished ones from colleagues (4)." The list of datasets analyzed is given on page xv. Having access to 42 spatial datasets would be like paradise—but where is the data in the book or where can it be located on the Web? The authors thank "Ms. Michele Griffith for helping us retrieve a number of data sets from Internet sources" (p. x), but the corresponding URL's are not given. In the list of datasets on page xv, the URL or a text reference clearly should have been given to make this information useful. An even better option would have been to use freely available datasets owned by the authors or their colleagues and to provide them on a floppy disk or CD accompanying the book or to publish them through the Web. Examples of where this approach has been taken are the books by Bailey and Gatrell (1995), in which 28 datasets discussed are available on an accompanying floppy disk, or Venables and Ripley (1997), in which data and software, including about 20 spatial datasets, are available via the Web (*http://www.stats.ox.ac.uk/pub/MASS2*).

Finally, obtaining new SAS, SPSS, and ArcView/Avenue program code for spatial statistical data analysis could definitely be worth purchasing this book. But having about 80 pages of printed computer code is a waste of paper. One could do much better via floppy, CD, or the Web. Examples in which spatial statistical software is available via a floppy accompanying a book are those of Pannatier (1996) and Bailey and Gatrell (1995). Examples in which spatial statistical software is freely available via the Web are the book by Venables and Ripley (1997) and the SPLANCS software from Rowlingson and Diggle (1993) (*http://www.maths.lancs.ac.uk/Software/Splancs/*). However, I have to acknowledge that the authors have been very supportive in sending computer code and datasets via email. Nevertheless, this is far from what is the standard elsewhere.

For those readers who do not worry too much about these disadvantages, the selection of spatial datasets and their analysis is certainly worth a closer look. But for readers who want a more accurate book that also provides immediate access to software and spatial datasets, Bailey and Gatrell (1995), Venables and Ripley (1997) (now even a third edition from 1999 is available), or Pannatier (1996) might be a better choice.

Addressing the listed problems in a second revised edition of this book would considerably raise its overall value. If the authors decide to make additional material available on the Web prior to a second edition, the best guesses where such material may end up are at the Oxford University Press (i.e., the publisher's) Web site at *http://www.oup-usa.org/isbn/0195109589.html* or at Daniel Griffith's personal Web site at *http://www.maxwell.syr.edu/geo/GRIFFITH.htm*.

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Statistical Inference in Science, by D. A. Sprott, New York: Springer-Verlag, 2000, ISBN 0-387-95019-2, xv + 245 pp., $69.95

This book is from Springer series in statistics, and the author claims that it is intended for senior undergraduate students or master's students. It assumes that a student is familiar with probability up to the level of Kalbfleisch (1979) or Feller (1966). Before the first chapter, this book gives a list of all the examples in the book, which is very useful to a reader for locating examples easily. Contrary to the popular tradition of providing problems or exercises at the end of each chapter, this book provides problems for the first 10 chapters in Chapter 11. This book is divided into 11 chapters as follows:

1. Introduction
2. The Likelihood Function
3. Division of Sample Information I: Likelihood θ, Model f
4. Division of Sample Information II: Likelihood Structure
5. Estimation Statements
6. Tests of Significance
7. The Location-Scale Pivotal Model
8. The Gauss Linear Model
9. Maximum Likelihood Estimation
10. Controlled Experiments
11. Problems

The author's style is very laid back, making this book easy to read. Even slightly difficult concepts are made easy to understand. The layout of the book is less like a textbook and more like a reference book. Any teacher using this book will have to supplement information while teaching, including some explanation for examples. The author uses graphical displays nicely throughout the book to illustrate different points. About every couple of chapters, there is a section titled "notes and references." This section gives some historical development leading to the topics covered in the previous sections. Most of the historical development given is descriptive rather than mathematical.

One plus point about this book is plenty of examples scattered throughout. Some examples are more general, whereas others are distribution specific. Most of the examples are derived from real-life experiments, and the data are reported from different publications. Many examples used are continued through different chapters. Such continuation of examples helps students in understanding the connection between different analysis techniques, as well as giving possible alternative methods for solving the same problem. There are few examples of interest to engineers, such as analysis of failure times, but many examples are from the biological sciences and medicine.

One slightly negative point about this book is the exercises. All the exercises are of good quality, but they are all given in Chapter 11, at the end of the book. It is an inconvenience to a teacher. Although most of the exercises have several subsections, there are only 38 exercises. It means a teacher will have to choose and pick appropriate subquestions for homework during coverage of different chapters or supplement homework exercises from other sources. Teachers would be delighted if there were exercises covering topics across different chapters (like the ones in this book) in addition to the appropriate exercises at the end of each chapter.

The chapter on estimation contains information about confidence intervals, likelihood-confidence intervals, likelihood-fiducial intervals, likelihood-Bayes intervals, and maximum likelihood estimation. It also includes a section on bias reduction and maximum likelihood estimation. But this is a lot of material to be covered in just 10 pages, which means it is not covered in enough depth, and a teacher will be responsible for supplementing it from other sources. The same goes for the chapter on tests of significance. This chapter begins with goodness of fit and tests of homogeneity and then moves on to the parametric tests, where the author describes the difference between the testing and the estimation, the power of a test, and the conditional inference.

In conclusion, it is a nicely written book but may not be suitable by itself as a textbook.

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Risk Modeling for Determining Value and Decision Making, by Glenn Koller, Boca Raton, FL: Chapman and Hall/CRC, 2000, ISBN 1-58488-167-4, xiv + 321 pp., $49.95.

This book is a follow-up to a previous book entitled *Risk Assessment and Decision Making in Business and Industry: A Practical Guide* (Koller 1999). The earlier book focused on risk assessment methods. The new book's primary aim is to present in-depth examples of the application of the methods described in the earlier work.

Examples of risk modeling compose the first 11 chapters of this book. Chapters 12–18 are repeats (with some modification) of material from the first book—included at the insistence of the publisher according to the author. Having not read the first book, I read Chapters 12–18 of the current book prior to Chapters 1–11.

My first impression of this book was that its focus is on business decision making and its tilt is toward use by managers. I am a consulting statistician and read *Technometrics* because I routinely work with practicing scientists and engineers. However, on occasion I am called upon to provide input to more business-related projects or to business decisions related to engineering or scientific projects. Hence, there is some potential applicability of the topics covered in this book to my work. If this is also true for other *Technometrics* readers, they might have some interest in it as well.

I like to learn by example, and this book accommodates that. The examples presented are not real examples. Instead, they follow a fictitious individual or set of individuals through the process of risk modeling for a particular scenario. The author uses fictitious examples because he feels actual cases are generally too complex to present without being bogged down in irrelevant details. His examples are intended to be "comprehensive enough to have credibility while hopefully retaining the quality of being eminently readable." I think the author has succeeded fairly well in this regard. The examples are easy to follow, but you also get the flavor of how difficult the process is in real life, and he takes pains to show in the examples that there are no easy answers to some of these problems. I do wonder if the sex ratio of his fictitious characters (one female vs. fifteen males by my count) is a realistic representation of real-life business environments. If it is, that is too bad. If it is not, it is too bad he chose to represent it that way.

Each example chapter ends with a section entitled "So, so what?" These sections nicely summarize the issues presented and their implications. Most of the chapters also present some computer code illustrating how the risk model can be implemented. The code presented is from risk assessment software that is not generally available and thus is of little direct use. However, to the extent that the exact logic of the risk model described in the narrative is made more clear by examining the code, it does have some usefulness.

This book definitely emphasizes the softer side of risk analysis rather than the mathematical and statistical aspects of the modeling process. Much coverage is given to the complexity of problem definition (i.e., deciding just what the question is), how to define parameters of models, how to bring divergent individuals and groups to a consensus on these issues, how to avoid manipulation by users to favor a pet project, and other aspects of a study that need to be addressed prior to beginning serious number crunching. These important steps prevent a meaningless "garbage-in garbage-out analysis" but are often the most difficult part of the whole process. The author stresses repeatedly that it is the process rather than the results that are most important. At one point he even states that, in the end, the model may or may not be beneficial or even accurate, but that benefit is derived from having gone through the process.

There is much in this book to irritate an academically trained statistician or a rigorous scientist or engineer using statistics. The author eschews common statistical terms to "insulate and isolate others [nonstatisticians] from the rigors and details of statistics." He refers to this as "statistics free" risk assessment, but all he is really doing is redefining statistical terms in an attempt to make users feel more comfortable. Making users comfortable is a laudable goal, but unless the nonstandard terms are adequately defined, the assessment of the quality of the resulting risk models may be impaired. Although the author's goal is trying to make people more comfortable with some of the difficult issues in risk analysis, it is not apparent that he is doing much but creating his own jargon that is often no more insightful than the more standard statistical terms. A few examples illustrates this issue.

When discussing probability distributions, the author prefers to use names descriptive of shape (symmetrical, skewed, spike, flat, truncated, and bimodal) rather than specific names such as normal, Poisson, and gamma. Of the standard names for statistical distributions, the author states: "this type of jargon is required if you want to be 'a member of the club' and proliferate the erudite haze that shrouds statistics. . . ." However, the distributions he defines are not completely specified in that one would be hard pressed to derive a density function based on the criteria given. Furthermore, the author is not completely immune from proliferating the erudite haze himself, having referred specifically to the use of the lognormal distribution to describe some data three pages prior to make the statement just quoted. He also uses terms such as mean, median, mode, asymptotic, kurtosis, X-Y space, Latin hypercube, and so forth in his discussion of probability distributions with little or no definition. One has to wonder if a reader who is uncomfortable with calling a normal distribution by its real name will understand or appreciate these other statistical terms.

The author continues his nonstandard treatment of probability distributions in his method of specifying distribution parameters for variables in Monte Carlo analysis. His approach creates distributions based on a user's assessment of several characteristics—minimum value, most likely value, maximum value, and peakedness, without adequately defining the concepts used or explaining exactly how to translate them into specific probabilities. (Perhaps this was all explained in his previous book.)

The author says he invented the concept of peakedness because he felt kurtosis would be too foreign to nontechnical users. This may be true, but for those who do appreciate the technical details it would be nice to see how his 0 to 10 scale of peakedness values actually is used to derive probabilities. One might guess that a peakedness value of 10 means all probability exists at one point or that a value of 0 represents a uniform distribution. His examples show this is not the case, however. (A uniform distribution is available under another specification, that of a "flat" distribution. Personally, I find the word uniform to be just as easily interpretable as flat in describing a distribution.)

The relationship of the term "most likely value" with the usual measures of central tendency is also not revealed. These definition issues are not minor points because they create a situation in which differences between model outputs based on the concepts in this book and other risk models cannot be adequately explored. Besides, without the author's own software, there is no way of converting these concepts into actual distributions to use in the Monte Carlo sampling process. It would have also been nice to show how to derive distribution parameters based on empirical data, even though (as the author points out) it is often scarce. In the examples, almost all values of minimum, most likely, and maximum—but especially peakedness—were set almost magically based on group consensus.

This book makes for some interesting reading and is notable for addressing important nontechnical issues related to modeling risk. If the derision and poorly defined statistical elements of the book are ignored, it may be useful for statisticians required to work with management rather than engineers or scientists. If nothing else, it provides insight into the way in which some nontechnical people think, thus offering a potential for better communication with business-oriented clients.

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REFERENCE

Koller, G. (1999), *Risk Assessment and Decision Making in Business and Industry: A Practical Guide*, Boca Raton, FL: CRC Press.

Modeling, Analysis, Design, and Control of Stochastic Systems, by V. G. Kulkarni, New York: Springer-Verlag, 1999, ISBN 0-387-98725-9, xiv + 374 pp., $69.95.

This is a nice book on applied stochastic processes for senior undergraduates or first-year graduate students. The book aims at getting students to try out the material on a computer as early as possible, and I think that is a great plus!

Chapters 1–4 contain a probability introduction that covers univariate and joint distributions, random variables, conditional probability, expectation, conditional expectation, and the like. This is fairly standard with many books on the subject. The chapters provide a nice review and should be understandable to students from other disciplines such as computer science, psychology, anthropology, and so forth who may be in such a course.

The core material begins in Chapter 5 by defining discrete-time Markov chains. The introductory examples are simplified models for machine reliability, weather, inventory systems, manufacturing, manpower planning, stock markets, and packet switching in communications. They are carried throughout the chapter and used for introducing transition matrices, state transition diagrams, the Chapman–Kolmogorov equations, occupancy times, and limiting behavior. There is a short section on cost modeling and first passage times. Although the examples are not based on real data, they are realistic enough to maintain the reader's interest. Having students work with numerical examples as soon as possible helps to reinforce the concepts.

Chapter 6 deals with continuous-time Markov chains. The development is analogous to that of discrete-time Markov chains. Topics introduced are Poisson processes, birth and death processes, first passage times, mean sojourn time in a state, transient and limiting distributions, and cost models. The examples involve reliability, telephone switching, traffic-control mechanisms in digital telecommunications networks, and inventory management. They are realistically presented and accessible to the student.

Chapter 7 briefly covers renewal theory, renewal reward processes, and semi-Markov processes. These topics are difficult for students in an introductory course, so I think a brief introduction such as this is valuable and appropriate. Chapter 8 is on queuing models. It contains an exhaustive discussion presenting single- and multiple-server Markovian queues with finite and infinite capacity. Both the M/G/1 and G/M/1 queues are examined. The last section considers Jackson networks with a simple example. In a one-semester course, if time were short, I would recommend skipping Chapter 7 but covering 8.

Chapters 9 and 10 address design and control. Although it is nice to have these chapters in the book, in a traditional one-semester course I doubt that one could cover them. Nonetheless, they allow the interested student a glimpse into these important areas. Traditionally, stochastic processes courses are not concerned with data analysis. They spend a lot of time on the modeling and analysis of systems with fixed parameters. Yet, anyone attempting to use these models for real problems needs to know how to handle data! Chapters 9 and 10 do not focus on estimation, but at least they begin with the first step of recognizing that the parameters are unknown and developing an understanding of static and dynamic control. The topics covered include optimal number of servers in a queue, optimal replacement in reliability, optimal server allocation, inventory control, and control for Markov decision processes.

By happy coincidence, I was about a month into teaching introductory stochastic processes when this book arrived for review, so I tried out some of the examples from Chapters 5–8 on my class. The course was a mixed-level class of graduate students from biology, computer science, psychology, anthropology, and statistics. The examples seemed accessible to out-of-department students and statistics master-level students. This book is written at a lower mathematical level than many other introductory stochastic processes books such as those of Taylor and Karlin (1993) and Resnick (1992) but for the mixed group of students that I was teaching, the level would probably have been appropriate. For courses such as ours, this book should certainly be considered as a possible textbook.

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REFERENCE

Resnick, S. (1992), *Adventures in Stochastic Processes*, Boston: Birkhauser.
Taylor, H., and Karlin, S. (1993), *An Introduction to Stochastic Modeling*, London: Academic Press.

Stat Labs: Mathematical Statistics Through Applications, by Deborah Nolan and Terry Speed, New York: Springer-Verlag, 2000, ISBN 0-387-98974-9, xviii + 282 $34.95.

This is not a typical mathematical statistics book. From the outside back cover, I quote, "(it) blends mathematical statistics with modern statistical practice. It turns the traditional teaching of mathematical statistics on its head by making a case study the centerpiece of each chapter. Chapters begin with the introduction of a real problem followed by a description of the data collected to address the problem, rich background material to put the problem in context, and suggestions for investigating the problem. This novel approach to bringing data analysis into the theoretical course is ideal for motivating and illustrating standard statistical techniques, for helping students understand mathematical statistics, and for showing how statistics can be useful in a wide variety of situations." The 282-page, relatively inexpensive paperback is intended for a calculus-based introductory statistics course for undergraduates at the junior and/or at the senior level. Various topics are introduced in practical contexts so that the students first get a feel for situations in which such a topic is relevant before learning the theory, which is also provided. This feature, applications (i.e., questions) first and theory second, seems like a good way to teach a subject like statistics, in which motivation (or lack thereof) constitutes an integral part of a measure of a book's and/or a teacher's success, particularly at the undergraduate level.

There are 12 chapters and 3 appendixes in this book. These are as follows:

1. Maternal Smoking and Infant Health
2. Who Plays Video Games?
3. Minnesota Radon Levels
4. Patterns in DNA
5. Can She Taste the Difference?
6. HIV Infection in Hemophiliacs
7. Dungeness Crab Growth
8. Calibrating a Snow Gauge
9. Voting Behavior
10. Maternal Smoking and Infant Health (continued)
11. A Mouse Model for Down Syndrome
12. Helicopter Design

Appendix A: Writing Lab Reports
Appendix B: Probability
Appendix C: Tables

The authors suggest including Chapters 1, 2, 4, and 7 as core chapters in a course, covering topics such as descriptive statistics, simple random sampling, estimation, testing, and regression. There are topics here not typically found in books at this level. These include bootstrapping, Fisher's exact test, delta method, Mantel–Haenszel test, geometry of least squares, quantile plots, and so on. On balance, however, the discussion on hypothesis testing is rather sparse (there is no mention of the Neyman–Pearson theory or the likelihood ratio tests).

As mentioned earlier, each chapter begins with a story, from a recent newspaper article (from the *New York Times* or the *San Francisco Chronicle*) that introduces various scenarios, problems, and questions. For example, Chapter 1 begins with a part of the March 1, 1995, *New York Times* story headlined "Infant Deaths Tied to Premature Births." This is followed by "Introduction," "The Data," "Background (Fetal Development, Rubella, A Physical Model, Is the Difference Important?)," "Investigations," and "Theory (The Histogram, Numerical Summaries, Five-Number Summary, Box-and-Whisker Plot, The Normal Curve, Quantile Plots, Cross-tabulations, Bar Charts, and Segmented Bar Charts)," and finally "Exercises." There are plenty of good problems in the exercises section and these are of types that should please both the theory- and the application-oriented readers.

As a second example, consider Chapter 8, titled "Calibrating a Snow Gauge," which begins with a May 1, 1995, story from the *San Francisco Examiner* headlined "Rain Prompts Small-Stream Flood Warning." This chapter deals with regression analysis; the sections are "Introduction," 'The Data," "Background," "The Gauge" (which includes a physical model), "Investigations," "Theory (The Simple Linear Model, Model Misfit, Transformations, Residual Plots, Replicate Measurements, Confidence and Prediction Bands, Calibration, Maximum Likelihood, An Alternative)," "Exercises," "Notes," and "References."

I liked this book—its organization, its presentation, and the style of writing. In my scanning, I did not catch any typographical errors. The work clearly gives the impression that these authors have taken the time to think through what they wanted to do and have made an effort to do it. The headings of the chapters listed previously indicate the depth of their coverage; I would like to highlight the contents of Appendix A, titled "Writing Lab Reports." Everyone agrees how important developing writing and communication skills are. Here one can find step-by-step instructions on such topics as organization, grammar (including examples of grammatical problems), clarity and structure of prose, and revising and proofreading. Quite frankly, I cannot think of any statistics book, particularly at this level and for this type of material, in which such discussions can be found. This appendix, even by itself, should be on the must-read list for all students, including graduate students.

Of course, there are additional topics that one would like to see included. Some of these are even mentioned in the article titled "Teaching Statistics Theory Through Applicaitons," (Nolan and Speed 1999, pp. 370–375) by the same authors. The additional topics could include more details on things like the moment-generating function, the methods of deriving distributions of transformation of random variables, concepts of estimation such as sufficiency and minimum variance, and others. In fact, the authors might consider doing a second volume; that way more time and space can be devoted to more concepts. More guidelines on how to use a particular computer package (the authors mention two) in a given situation would be helpful; this could include step-by-step instructions and annotated printouts. I also think (the title of the book suggests this) that, given the nature of the material, this way of teaching would require (and greatly benefit from) a solid support mechanism from outside the classroom. An essential component of such support would have to be recitation and/or lab sections (as the authors have used) with dependable teaching assistants.

It seems fair to say that the look and feel of many popular mathematical statistics books have not changed much in years. The standard formula is to do much theory first and then some examples; many of these examples often appear as afterthoughts. Recently however, there have been calls for a change in this formula (e.g., see Cobb and Moore 1997). One suggestion is to shift the focus to problem solving, using existing (or developing new) mathematical-statistical and subject-matter theory rather than developing new theory to solve problems that could arise in the future. An implementation of this strategy would require a paradigm shift in the teaching of mathematical statistics, and that is easier said than done. However, it is worth pointing out that a similar paradigm shift did take place in the teaching of statistical methods a few years ago. As I recall, following discussions between academia and industry, textbooks began to appear that emphasized the problem-solving approach to learning statistics by providing more real-life examples and case studies. Thanks to these authors, there are a number of fine books and supplementary materials available now for teaching statistical methods, particularly at the undergraduate level. The present book could start a similar trend among the mathematical statistics textbooks.

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Introduction to Matrix Analytic Methods in Stochastic Modeling, by G. Latouche and V. Ramaswami, Philadelphia, PA: ASA-SIAM, 1999, ISBN 0-89871-425-7, xiv + 334 pp., $49.50.

This is primarily a reference book (xiv + 334 pages) outlining the basic mathematical ideas and algorithms of matrix analytic theory. The intended audience includes applied probabilists, systems analysts, statisticians, and a variety of engineers (electrical, communication, computer, and industrial). The stated prerequisites are undergraduate advanced calculus, linear algebra, and a course in stochastic processes at the level of Karlin and Taylor (1975, Vol. 1), I believe that the diligent reader could also use the book as a textbook, working through omitted proof steps, checking the given proofs, and completing omitted proofs. Overall, the book is useful, written by recognized experts who have published extensively in the area, and I recommend it for anyone who is trying to learn about matrix analytical methods.

I wanted to review this book after seeing it advertised in the September 2000 *Journal of the American Statistical Association* and realizing that I did not know what "matrix analytic methods" are (despite having taken several courses in stochastic processes during graduate school in the early 1990s). I began to get curious about whether I had simply overlooked an important area of stochastic modeling. A quick Web search revealed discussion groups, software, and conferences devoted to matrix analytical methods (pioneered and still promoted by M. Neuts), so I thought it would be time well spent to fill in this gap in my education by reviewing the book. Note, therefore, that I have no previous experience with matrix analytic methods, so I will not attempt to compare the book to other books or research papers on the topic, but rather I will evaluate it on the basis of whether it meets its intended goal of being a self-study guide or possibly a graduate-level textbook.

First, I like the terse wording style, but I point out that the proofs seem to me to be a mixture of rigorous mathematical proofs and heuristics, with no clear guidance given to the ignorant reader (me) when rigor is being sacrificed for clarity or brevity. Occasional hints regarding more rigorous concepts (e.g., the notion of "denseness" of probability measures is mentioned but not used on p. 54) are given. Overall, the book tries to introduce a considerable amount of material with full or partial proofs, serving mostly as a survey book, but the diligent reader could probably treat it as a textbook and reproduce the proofs. In one instance (p. 51), a proof (for a continuous case) was assigned as an exercise to the reader after the proof was given for the discrete case. There are other "prove the omitted case" exercises in the book.

What are matrix analytic methods? The informal definition seems to include the "matrix-geometric" distribution (Chap. 4) and "phase-type (PH)" processes (Chap. 2), and one key fact is that the matrices involved have direct probabilistic interpretations while the often-used eigenvalues in spectral treatments do not. There are five main book parts with motivating example quasi-birth-death (QBD) processes in Part I, PH processes in Part II, the matrix-geometric distribution in Part III, algorithms in Part IV, and "Beyond Simple QBDs" in Part V.

One key concept in Part I is to include an "environment" variable in a simple $M/M/1$ model. This notation means that the arrival times have distribution M (exponential), service times have distribution M, and the queue is single server. The environment variable allows the arrival and/or service rates (the "state") to change and leads to a block-tridiagonal infinitesimal generator matrix Q. A second key concept is to generalize the exponential distribution, allowing service and/or arrival times to have a PH distribution. The PH random variable is defined on states $\{0, 1, 2, \ldots, n\}$ in Part II via an initial probability vector (τ_0, τ), where τ_0 is a scalar and τ is a row vector of length n. Let T be an n by n matrix, $\mathbf{t}$ be a column of length n, and 0 be a row of length n. Then the infinitesimal generator is

$$Q = \begin{pmatrix} 0 & 0 \\ \mathbf{t} & T \end{pmatrix}$$

and the distribution of the time X until absorption into absorbing state 0 is called the PH distribution with distribution function $\mathrm{F}(x) = 1 - \tau \exp(Tx)1$, where the matrix exponential is defined by $\exp(A) = \sum 1/n!A^n$ (proof given). The matrix-geometric property is formally defined in Chapter 6 (Part III) via Theorem 6.2.1: If a QBD is positive recurrent, then there exists a nonnegative matrix N of order m such that $\pi_{n+1} = \pi_n A_0 N$ for $n \geq 0$, where the transition probability matrix P is block tridiagonal of form

$$P = \begin{pmatrix} B & A_0 & 0 & 0 & \cdots \\ A_2 & A_1 & A_0 & 0 & \cdots \\ 0 & A_2 & A_1 & A_0 & \cdots \\ 0 & 0 & A_2 & A_1 & \cdots \end{pmatrix}.$$

This result is often written as $\pi_{n+1} = \pi_0 R^n$ for $R^n = A_0 N$.

Overall, the book's strengths include (1) a logical progression, via the progressively more complex QBD examples in part I, to the PH and matrix-geometric distributions; (2) a terse but clear writing style; (3) a sense of where the field is progressing given in Part V; and (4) an authoritative presentation by recognized experts. I think the book could be improved with three very simple steps. First, for the reader's convenience, include a few brief appendixes with the relevant background results, jargon, and notation from the first course in stochastic processes. For example, it would be good to motivate key ideas like the generator matrix Q using simple probabilistic arguments starting from the Chapman–Kolmorogov (Karlin and Taylor 1975, 1981) equation. Second, make it clear when proofs are rigorous and when they are not. Third, the examples appear to me to be the commonly used ones from queuing theory and I wonder about real applications, for example, in the communications field. Do the "real-world examples" involve technical challenges beyond the vanilla textbook descriptions? Because I lack experience in the field, I would greatly benefit from a "real applications" section.

The book is a welcome and useful addition to my collection as it is regardless of whether any of the suggested improvements are included.

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Editor Reports on New Editions, Proceedings, Collections, and Other Books

This section reports on new editions of books previously reviewed in *Technometrics,* collections of papers and conference proceedings, and other statistics books that should have some interest for the readership. Selections and comments do not represent any perspective of the editor's employer or of the sponsoring societies.

Eric R. Ziegel
BP

Basic Engineering Data Collection and Analysis, by Stephen B. Vardeman and J. Marcus Jobe, Pacific Grove, CA: Duxbury, 2001, ISBN 0-534-36957-X, xvi + 832 pp. + CD, $76.95.

The Preface begins, "This book is an abridgement and modernization of Vardeman (1994)." That is a new one for me. It goes on to note that "the present book preserves the best features, improving readability and accessibility for engineering students and working engineers, and providing the most essential material in a more compact text." The last is a strange description for a book that has 850 pages in fairly large format. In fact, Vardeman (1994) had only 811 pages.

See Brugger (1995) for a complete review of the content of Vardeman (1994). Generally that suffices quite well for this book, since the content has undergone little overt change. Chapter 10 in the original book, which concerned fractional factorial designs, was tacked onto the end of the chapter on factorial designs. An appendix on the matrix representation of multiple regression was eliminated. Otherwise the layout of the book is the same. A new publisher and possibly a lack of success for Vardeman (1994) perhaps led to the new title instead of a designation as a second edition. This meets my standards for a second edition.

Brugger (1995) noted that "the methods of presentation of the material in the book is not what one usually finds in the textbook on engineering statistics" (p. 348). Brugger described the presentation as "a storyline of engineering problems or experiments and which brings in the statistical methods as needed." He concluded, "Overall I think the book has merit for instructional purposes" but he was not so enthusiastic concerning its values as a reference.

Despite the building of the methodology on case studies, the book has a very traditional feel to it. It is full of equations and formulas. Minitab®, JMP®, and Excel® are all featured for computations, but these are more adjuncts to the book than its emphasis. Perhaps focusing learning for engineers on equations and formulas works well in universities, but for industry short courses and desktop reference usage, the book needs to emphasize the use of software. Most engineers, in large companies at least, have some desktop statistics package and need to have a resource that can help them use it.

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Brugger, R. (1995), Review of *Statistics for Engineering Problem Solving,* by S. Vardeman, *Technometrics,* 37, 348.

Vardeman, S. (1994), *Statistics for Engineering Problem Solving,* Boston: PWS Publishing.

Business Statistics in Practice (2nd ed., Instructor's) by Bruce Bowerman, Richard T. O'Connell, and Michael L. Hand, New York: McGraw-Hill, 2001, ISBN 0-07-241535-5, xxxii + 856 pp., $93.75.

This is the second edition (2E) of one of the biggest and heaviest statistics books that I have ever seen. The first edition, not reviewed by *Technometrics,* had more than 1,200 pages. The authors were only modestly successful in reducing the book's size for the 2E. This is the first hardcover $8\frac{1}{2} \times 11$-inch volume that I can recall, it still has almost 900 pages, and it still weighs a ton. Quite a lot of material was shunted off to nine appendixes that are on the accompanying CD-ROM. That is a nice strategy for authors who like words, examples, and exercises, all profuse here.

This is the second business textbook in recent weeks that I have encountered that opens with several pages explaining why it is the best book to use. See also Levine, Berenson, and Stephan (1999), reported by Ziegel (2001). Differentiating features here include case studies; Excel and Minitab tutorials; Internet tutorials; chapter introductions including overviews of case studies; boxes for equations, formulas, and definitions; Excel, Minitab, and SAS outputs; and chapter summaries with glossaries and formula references. The book also has a CD-ROM that includes templates and an add-in for Excel, Powerpoint slides, the aforementioned appendixes, and a software package called Visual Statistics. There is even a Web site for the book that has a host of additional resources.

One might think that one could streamline the textbook when all of these other learning devices are available. This book has a "more is better" approach. For one thing, the approach is very traditional, so there are many equations and formulas. There are tons of examples and illustrations. There are extensive lists of problems. In addition to all of this, it is just a very wordy book. Everything in every place is described with seemingly endless verbiage.

The book has 18 chapters. It takes six chapters and 240 pages to get through probability, distributions, and descriptive statistics. Another three chapters and 150 pages carry the book through hypothesis testing and confidence intervals. Next come four chapters and 250 pages on regression analysis and linear models. The last 200 pages are devoted to five single-topic chapters—time series forecasting, control charts, nonparametric methods, chi-squared tests, and decision analysis.

This book probably works in industry as a reference book. It is complete, though the wordiness would hamper its use in that context. It is a very handsome book.

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Ziegel, E. (2001), Editor Report for *Statistics for Managers Using Microsoft® Excel* (2nd ed.), by D. Levine, M. Berenson, and D. Stephan, *Technometrics,* 43, 248.

The Basic Practice of Statistics (2nd ed.), by David S. Moore, New York: W.H. Freeman, 2000, ISBN 0-7167-3627-6, xxxi + 619 pp. + CD, $72.95.

This book is the little brother to Moore and McCabe (1999), which recently had its third edition, as reported by Ziegel (2001). Previously the first edition (1E) of the book was reviewed for *Technometrics* by Moore (1996). It received a solid endorsement in the reviewer's summary: "I believe that all introductory students would benefit from this style of presentation, which minimizes the distraction of the mathematics of probability and statistics, emphasizing exploratory data analysis, sampling, and experimental design concepts, and encouraging the development of insight and understanding afforded by the use of statistical inference" (p. 404). The review described the content of the book in equally imposing sentences.

As the quote indicates, this book is classical statistics presented as gently as possible. The author is widely renowned for this approach. Moore and McCabe (1999) gave an even bigger dose of the same type of stuff. The book is intended to be suitable for use in two-year colleges, so this version of this approach is very basic. Computing within the book is at the level of the "two-variable statistics calculator," Excel, and Minitab. Using the "classical approach," it certainly involves less statistical computing than I would present.

As a second edition (2E), there are not many changes from the first edition. Some probability material was separated from the chapter on probability and sampling distributions, made into a following chapter on probability theory, and labeled as optional. It is not hard to agree with that decision. There is a new chapter on nonparametric statistics tacked on at the end of the book. There also is a nice shiny CD-ROM packaged with the 2E that includes an encyclopedia of examples, datasets, quizzes, a Web link for updates, and some additional text sections that are not in the book. The book has been reformatted in a four-color layout. It now includes new chapter introductions and adds chapter summary sections.

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Ziegel, E. (2001), Editor Report for *Introduction to the Practice of Statistics* (3rd ed.), by D. Moore and G. McCabe, *Technometrics,* 43, 245.

Sensitivity Analysis, edited by Andrea Saltelli, Karen Chan, and E. Marian Scott, West Sussex, U.K.: Wiley, 2000, ISBN 0-471-99892-3, xv + 475 pp., $89.95.

This large, long, beautifully presented volume from the publisher's Series in Probability and Statistics essentially presents a topic that was new to me. I knew about sensitivity analysis in regression (e.g., see Chatterjee, Hodi, and Price 2000). Chapter 1 ("What Is Sensitivity Analysis?"), verse one, states, "Sensitivity analysis is the study of how variation in the output of a model can be apportioned, qualitatively or quantitatively, to different sources of variation, and of how the given model depends upon the information fed into it." Ignoring the writing style, one does glean that the subject is inclusive of a lot of stuff. The book was given a trial run at the Summer School on Sensitivity Analysis held in Venice in 1999, another one of those instances in which it was nice for a group of people to get their expenses paid for what surely was a very pleasurable trip.

The book has four sections:

I. Introduction
II. Methods
III. Applications
IV. Conclusions

The first part includes just two chapters. In addition, to the "what it is" chapter, there is also a "Hitchhikers Guide to Sensitivity Analysis." The opening chapter continues, along with an example (dry cleaning bill!), sections on why, how, and what, and an overview of the book. The "guide" is the actual methodology overview, touching on a wide variety of applications and tools. Many of these fall squarely in physical and engineering sciences—screening designs, differential models, Monte Carlo models, response surfaces. There are also just two conclusion chapters at the end of the book. One is about ensuring the quality of predictive models, and the other serves up the inevitable perspective on the current and future state of an unusual methodology.

In between these paired chapter bookends is a huge set of useful methodology and great applications. The methods chapters include chapters on experimental design, screening designs, reliability analysis, parameter estimation, and graphical tools. Some of the chapters are discursive overviews, others include a focus on detailed methodology, and still others are built around their case studies. The applications chapters begin with a chapter, "Practical Experience in Applying Sensitivity and Uncertainty Analysis," that focuses on modeling and descriptions of the other applications chapters. Topics for the examples are nuclear waste disposal risk assessment, signal extraction for economic time series, recalibration analysis, solid-state physics, effect of groundwater pressure decreases on ground subsidence, nonlinear modeling for ozone predictions, chemical reaction modeling, fish population dynamics, and environmental-policy modeling.

There are 21 pages of references. There is also a 15-page appendix on software, which is mostly homegrown stuff on Web sites. The book has a fair price that makes it only moderately expensive. I think this is a book that everyone who does modeling should buy. It can readily be read piecemeal, both the methods chapters and the application chapters, so it is ideal for leisurely self-study of an important part of modeling methodology.

REFERENCE

Chatterjee, S., Hadi, A., and Price, B. (2000), *Regression Analysis by Example* (3rd ed.), New York: Wiley.

Generalized Linear Models, edited by Dipak K. Dey, Sujit K. Ghosh, and Bani K. Mallick, New York: Marcel Dekker, 2000, ISBN 0-8247-9034-0, xvi + 423 pp., $195.

Subtitled *A Bayesian Perspective,* this book is a gathering of disparate chapters that are collectively intended to "serve as a comprehensive reference book for practitioners and researchers." (Preface, p. v.) The editors indicate that the book has been written for this audience "presupposing only basic knowledge of probability and statistics" (ibid.). I am not sure the editor told any of the authors about this objective. Generally one needs to have had the mathematical versions of these basic courses, and it seems advisable also to have had the introductory course in classical generalized linear models (GLM's), such as that of McCulloch and Searle (2001), before attacking this Bayesian version.

This really is a special-topics book for persons knowledgeable and experienced in using GLM's. In addition, the focus is generally on using Bayesian methodology in applying GLM's to problems. It is also part of the publisher's biostatistical series. The book has six sections and 23 chapters as follows (with chapter counts in parentheses):

1. General Overview (3)
2. Extending the GLMs (3)
3. Categorical and Longitudinal Data (5)
4. Semiparametric Approaches (4)
5. Model Diagnostics and Variable Selection in GLMs (3)
6. Challenging Approaches in GLMs (5)

In the first section are a paper on the Bayesian perspective for GLM's and two papers on generalized linear mixed models (GLMM's). The extensions of the second section are dynamic GLM's, Bayesian overdispersion, and inferences for small-area applications. Topics for the third section are correlated binary data, correlated ordinal data, time series count data, item response modeling, and Bayesian probit and logit models. The semiparametric approaches are summarized in the initial chapter of the fourth section, which is followed by two chapters on binary response regression and a final chapter on mixture models for survival data. The fifth section has two chapters on model diagnostics and one chapter on variable selection. Topics for the chapters in the last section are errors-in-variables modeling, compositional data, classification trees, binary spatial data, and graphical models.

For the Bayesians who have applications of research involving GLM's, this book would appear to have a fantastic selection of topics. There generally are applications, but the methodology is definitely dense. The chapters are usually compact; that is, they dive right into the topic at hand. People who can already do Bayesian computing will find some support in the book for adding some of these methods to their toolbox.

REFERENCE

McCulloch, C., and Searle, S. (2001), *Generalized, Linear, and Mixed Models,* New York: Wiley.

Managing Six Sigma, by Forrest Breyfogle, James Cupello, and Becki Meadows, New York: Wiley, 2001, ISBN 0-471-39673-7, xv + 272 pp., $49.95.

This book arrived when I had just begun participation on the team that was developing the business case for Six Sigma at BP Chemicals. Having a trans-Atlantic flight that needed an activity, I read through this book. Previously the first author had written the first of the new wave of Six Sigma books (Breyfogle 1999). In the *Technometrics* report, Gardner (2000) noted that, despite the title, the book had minimal content that would support persons who were interested in learning how to assess the value of the Six Sigma process. The book concentrated on its subtitle, *Smart Solutions Using Statistical Methods.* It was primarily a book about statistical tools. Here the author is back with two coauthors and a book that fits the title for the earlier book. This new and much smaller book, subtitled *A Practical Guide to Understanding, Assessing, and Implementing the Strategy that Yields Bottom-Line Success,* fulfilled very nicely my need for a management overview of the Six Sigma process.

The book has four parts and 14 mostly short chapters. The longest is the first chapter, which defines Six Sigma and then compares Six Sigma to much of the quality process spectrum that has preceded it. Particularly useful were the answers to a series of questions that people frequently ask about Six Sigma. The second chapter gives a lot of history, including experiences of a number of companies that have implemented Six Sigma and an explanation of its statistical definition. The last chapter in this section tries to sell the need for Six Sigma based mostly on quality costs. This chapter did not do a very good job representing Six Sigma as a new and better process.

There follow three chapters on Six Sigma metrics. The first chapter here, called "Numbers and Information," has an interesting approach to the use of control charting for infrequent data to see the big picture. A following chapter, "Crafting Insightful Metrics," devotes more space to the presentation on infrequent control charting. Licenses taken here with control charting will seem ill conceived to almost anyone with a background in control charts. For example, there are individuals charts for positive values that have negative lower control limits or individuals charts for data in which less than 20% are nonzero. Last in this section is a short chapter on performance metrics.

The next group of four chapters falls under the heading "Six Sigma Business Strategy." By this point the authors are totally preaching to the choir. There is essentially only one way for an organization to carry out the Six Sigma process, which is their way. Essentially, this is for the company to act like GE. That particular prescription is a huge pill for most companies to swallow. The chapter on deployment options makes an effective case for deployment through projects, not through training, and it argues that consultants are essential. The chapter on creating a successful Six Sigma infrastructure argues for the GE way. Similar content is found in the next chapter on training, which argues for external consultant trainers. It never mentions sending people to outside training. In this chapter Minitab is declared the winner in the Six Sigma statistical software derby. The last chapter in the set, "Project Selection, Sizing and Other Techniques," is one of the best chapters, though the specter of doing things because of Six Sigma, rather than pursuing logical needs for the business, lurks behind these processes. Despite intentions otherwise, the authors have difficulty separating their material from the manufacturing-for-customers environment.

The last part of the book, "Applying Six Sigma," presents three chapters with applications having a specific focus—manufacturing applications, service/transactional applications, and development applications. The latter have also assumed the label "Design for Six Sigma" in the provider marketplace. For each type of examples, a 21-step process for using Six Sigma tools is given across several pages of tables. There is a final chapter on creativity and innovation that is a nice enhancement to the overall methodology. The book has a nice glossary and an excellent reference list.

This book is very much an extension of Breyfogle (1999). There is considerable repetition and a lot of additional references. Its strength is its description and illustration of the many things that are important and necessary in the Six Sigma process. Its weakness is its adherence to the GE model and its impression that one should not bother if there is no Jack Welch mandate for the business to pursue the process.

For more on the GE experiences, see the excellent new book by Pande, Neuman, and Cavanagh (2000), or find the very popular book by Harry and Schroeder (2000) that is available in any bookstore. Comparatively, the Pande et al. book is a more straightforward presentation of Six Sigma implementation details. Its perspective is clear, and it is devoid of the hype of the other reference. It will help any business get Six Sigma off the ground in a way that is appropriate. For me Pande et al. (2000) is the best of all of the Six Sigma books because it promotes starting with a pilot effort, the direction that has been chosen for BP Chemicals.

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Breyfogle, F. (1999), *Implementing Six Sigma,* New York: Wiley.
Gardner, M. (2000), Review of *Implementing Six Sigma,* by F. Breyfogle, *Technometrics,* 42, 309–310.
Harry, M., and Schroeder, R. (2000), *Six Sigma,* New York: Doubleday.
Pande, P., Neuman, R., and Cavanagh, R. (2000), *The Six Sigma Way,* New York: McGraw-Hill.

Statistical Science in the Courtroom, edited by Joseph L. Gastwirth, New York: Springer-Verlag, 2000, ISBN 0-387-98997-8, xxii + 443 pp., $59.95.

I get enthused for legal applications of statistics after their highly publicized occurrences. None ever made a bigger splash than the excitement generated by the statistical consultant who helped George W. Bush prevail in a Florida bench trial a couple of months ago. Previously I dashed off a report for Zeisel and Kay (1997) in the months following the infamous "O.J." trial (see Ziegel 1999). Earlier I had reported on Finkelstein and Levin (1990) (see Ziegel 1992). These books for lawyers and their statistician friends or wannabees actually keep getting better and better. This one is a compilation of 22 separate chapters. With the absence of sectioning in the table of contents, the editor has provided a challenge for this quick summary report of the book.

The first two papers deal with cases involving drugs. They also display the two types of perspectives that are preponderant in the book. Though both papers are by eminent statisticians, the first mostly deals with statistical issues and how they supported the legal aspects of the dispute, while the second deals mostly with the legal aspects of the dispute and their relationship to statistical concepts. Definitely the second type of paper is more prevalent, constituting perhaps as much as 80% of the book.

After these first two papers, the next six papers all involve various aspects of the use of DNA evidence in trials. These are the most papers devoted to any particular topic. As with almost all the writers, the six authors are all statisticians. Probability theory and likelihood ratio testing are two statistical issues that are presented in some depth. Next, there are four papers that deal with cases involving discrimination. More germane to the petrochemical industry are the following two papers, which are concerned with cases involving epidemiological and toxicological issues. These are two environmental and health subject areas with an arsenal of associated statistical tools.

There is one paper from each side of the endless dispute over the effects of smoking. Every complex litigation worth millions of dollars involves statisticians on both sides. There are single papers on forensic statistics, litigation involving warranty contracts, and the deterrent effect of the death penalty. The last three chapters deal in a more general way with the use of statistical evidence. All three are concerned with the same case involving drug offenders, a case in which the various courts were not in concurrence concerning the value of the statistical evidence.

Any statistician and probably most lawyers can pick this book up and find it both enjoyable and valuable to read. It is certainly the best available tool to support either group in the effective use of expert witness testimony from statisticians in the courtroom.

REFERENCES

Finkelstein, M., and Levin, B. (1990), *Statistics for Lawyers,* New York: Springer-Verlag.
Zeisel, H., and Kaye, D. (1997), *Prove It With Figures,* New York: Springer-Verlag.

Ziegel, E. (1992), Editor Report for *Statistics for Lawyers,* by M. Finkelstein and B. Levin, *Technometrics,* 34, 122.
——— (1999), Editor Report for *Prove It With Figures,* by H. Zeisel and D. Kaye, *Technometrics,* 41, 181.

Statistics in Ecotoxicology, edited by Tim Sparks, New York: Wiley, 2000, ISBN 0-471-97299-1, x + 320 pp., $44.95.

Ecotoxicology is the application of toxicology to ecology, or perhaps it is the ecological applications of toxicology. Whatever, there previously have been reports in *Technometrics* on several books about statistics for toxicologists, most recently Krewski and Franklin (1991), reported by Ziegel (1995). There also have been reports on books about statistics for ecologists, such as Piegorsch and Bailer (1997), reported by Ziegel (1998). One would imagine that any of these books would have a broader or narrower audience, depending on whether the union or intersection of the two audiences is operable. This book probably works in the first mode.

The book ends with three case studies. The first is about problems with eggs for birds of prey, one ecological issue that happily is not relevant for BP. The second, "Statistical Techniques for the Ecological Risk Assessment of Chemicals in Fresh Water," certainly has a familiar theme to those of us who do statistics for a petrochemicals company. The last case study, "Trying to Detect Impacts in Marine Habitats: Comparison With Suitable Reference Areas," uses the Exxon Valdez as an example, so again there is industry relevance in my world.

Statistical methods are given a straightforward, concept-oriented presentation in the first seven chapters. The first chapter, which gives the basic concepts, covers probability, estimation, and testing, followed by a chapter on exploring data deals with distributions and statistics. A design-of-experiments chapter deals with field experiments. Next is a chapter on the analysis of laboratory toxicity experiments that covers a wide range of topics. The chapter on analysis of field studies has a nice discussion for both multiple regression and logistic regression. The material in the next chapter, multivariate analysis, includes principal components, correspondence analysis, multidimensional scaling, MANOVA, discriminant analysis, canonical variates, cluster analysis, and multivariate regression. The last of the methods chapters, which discusses environmental monitoring, is mostly concerned with nonparametric testing and trend analysis.

All of these chapters would be useful for environmental scientists. Generally these presentations are very traditional, not especially up-to-date, and devoid of much statistical computing. It is certainly easy to imagine other topics for each chapter and also to think of possible additional chapters. Overall there is enough value in this softcover edition to make it worth its cost for persons in ecology and toxicology.

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Krewski, D., and Franklin, C. (eds.) (1991), *Statistics in Toxicology,* New York: Gordon and Breach.
Piegorsch, W., and Bailer, A. (1997), *Statistics for Environmental Biology and Toxicology,* New York: Chapman & Hall.
Ziegel, E. (1995), Editor Report on *Statistics in Toxicology,* by D. Krewski and C. Franklin, *Technometrics,* 37, 356–357.
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Studies in the Atmospheric Sciences, edited by L. Mark Berliner, Douglas Nychka, and Timothy Hoar, New York: Springer-Verlag, 2000, ISBN 0-387-98757-6, x + 199 pp., $49.95.

The first thing I learned in reviewing this book was that there is a National Center for Atmospheric Research (NCAR). It is in Boulder, Colorado. In collaboration with the National Science Foundation, it established the Geophysical Statistics Project (GSP). This book presents some of the work of the GSP. The three editors wrote an introduction to statistics in climate and weather sciences. The remainder of the book consists of research reports and case studies by the post-docs who come to NCAR to do their statistics projects.

The topics for the papers that deal mostly with statistical methodology and the unique aspects of the statistical needs of problems in the atmospheric sciences are the following:

data assimilation for numeric models
multivariate spatial models
hierarchical space-time dynamic models
experimental design for spatial observations

These papers all demonstrate methodology at the post-doctorate level. This is not a collection of tutorials. However, most of these chapters devote several pages to their own case studies.

The papers that are case studies deal with the following topics:

stratospheric ozone levels
cloud parameterizations
tropical oceanic convection
predicting clear air turbulence
ocean color data

These papers also involve use of the necessary statistical methodology, including principal components, neural networks, discrete wavelet transforms, MARS, and spatial statistics. All of the case studies concentrate on the applications rather than the methodology that is used.

Statistical Aspects of BSE and vCJD, by Christl A. Donnelly and Neil M. Ferguson, Boca Raton, FL: Chapman & Hall/CRC, 2000, ISBN 0-8493-0386-9, 229 pp., $69.95.

This book went from the marginal-interest category to the complete-exclusion category until the recent flare-up of mad cow disease in France made it topical once again. The BSE, bovine spongiform encephalopathy, of the title is mad cow disease, and the vCJD is a new variant Creutzfeldt-Jakob disease, which is what humans who eat the infected meat from the mad cow can contract. This is one of those books intended to instruct both statisticians and scientists. It will teach statisticians about modeling the epidemiology of disease, and it will inform biologists about the use of rigorous statistical methods in modeling their data.

The first chapter gives an overview of the book, and the second chapter gives the medical background on BSE and vCHD. Chapter 3 talks about the available data, which is interesting because the data had to be cobbled together from many sources—databases, cohort studies, demographic models. Chapter 4 discusses modeling the diseases in populations, which is a combination of survival analysis and epidemiological modeling. This modeling was computationally intense and required programming that was done using SAS and S-PLUS. The results from these predictive modeling procedures are presented in a more comprehensible form in Chapter 5, which also includes a sensitivity analysis.

Disease modeling for individual cows and herds, which involves more conventional risk and survival analysis methods, is the subject for Chapter 6. The survival models are applied in Chapter 7 to modeling maternal risk. More complicated model structures that involve the consideration of spatio-temporal correlation and disease clustering are provided in Chapter 8. In Chapter 9 the models are applied to a stochastic simulation of BSE transmission dynamics. Last, in Chapter 10, with the models now in hand, it is possible to make predictions for the likelihood for a vCJD epidemic in the future. This is discussed through the evaluation of a number of different scenarios.

This book is really the presentation of one very large and extremely complex case study. The authors utilize a lot of statistical tools along the way. In addition to the obvious value from the assessment of the particular diseases in this book, the authors have laid out a nice template for anyone who is doing a similarly thorough assessment of a complex epidemiological system. For the most part the book is easily readable by either statisticians or biologists, though both groups will have to deal with the authors displaying high-level expertise in both domains.

Fitting Equations to Data (2nd ed.), by Cuthbert Daniel and Fred S. Wood, with the assistance of John W. Gorman, New York: Wiley, 1999, ISBN 0-471-37684-1, xviii + 458 pp., $59.95.

Book review editors get to pick and keep the books for their short reviews, so the selection is certainly biased. There are many drivers, such as paying homage to colleagues from one's past. This book is based on the two computer programs, LINWOOD and NONLINWOOD, linear and nonlinear regression programs, which were two of my principal tools when I began my career at Amoco as an industrial statistician. In addition, John Gorman, who is credited on the title page as an "assistant" in writing the book, was my Amoco mentor. Until his retirement, John handled the oil side of the business, while I handled chemicals and corporate. Fred Wood was our colleague in the general office. Cuthbert Daniel was a mentor to both Gorman and Wood as an occasional Amoco consultant and a friend of mine from summer conferences.

As I recall, Gorman forsook his role as the third author of this book because the book was so heavily tied to the two computer programs. Despite this possible deficiency, as a practice of classical regression methodology, the book is still fairly consistent with current procedures. There simply is not much that has been tacked on to the regression analyst's toolkit since 1980, when the second edition was produced. That did not change much from the first edition, written 1971, so this is 30-year-old technology. It is also 30-year-old computing, which has changed a lot. The programs vanished long ago at Amoco.

Some of the people reading this review were not even born when the first edition was written. Still, this is a grand historical document for industrial statistics in its glory days, as its selection for the Classics Library of this publisher implies. It would be great if the publisher could cover the cost of its press run with a lower purchase price.

Understanding Robust and Exploratory Data Analysis, edited by David C. Hoaglin, Frederick Mosteller, and John W. Tukey, New York: Wiley, 2000, ISBN 0-471-38491-7, xx + 445 pp., $69.95.

This was the first practical book on robust statistics when it was published in 1983. Previously Huber (1977) had served up the methodology as a mathematical treatise. This was similarly true for exploratory data analysis, though I am sure that Tukey (1977) considered his book to be eminently practical. It always seemed like one was reading in a foreign language when one studied that book.

This book is actually a collection of chapters. Seven other contributors were authors or coauthors, along with the three editors, of the 12 chapters in the book. The editors contributed to the publication of this edition as part of the publisher's classics library by writing a few sentences to summarize each chapter. These have been placed within the table of contents, since the original typesetting for the book is mostly reproduced. The editors do note that there were errors that were corrected in this reprinted version.

The publishers of this reprint series, and probably all publishers, are probably very tired of my constant criticism about price. However, a softcover book that is brand new would be a difficult purchase decision at $70 for even the wealthiest of statisticians. This book is 20 years old. Perhaps the publisher counts on the libraries having worn out their hardcover versions.

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Huber, P. (1977), *Robust Statistics,* Philadelphia: Society for Industrial and Applied Mathematics.

Tukey, J. W. (1977), *Exploratory Data Analysis,* Reading, MA: Addison-Wesley.

Forthcoming Reviews

Books listed here have been assigned for review in the past quarter. Publication of their reviews or reports generally would occur within the next four issues of the journal. Persons interested in reviewing specific books must notify the editor by the publication date for the book. Persons interested in being reviewers should contact the editor by electronic mail (*ziegeler@bp.com*).

Applied Probability Models, by D. L. Minh, Duxbury

Applied Regression Analysis for Business and Economics (3rd ed.), by Terry Dielman, Duxbury

Applied Stochastic Modelling, by Byron J. T. Morgan, Oxford University Press

Calibration and Reliability in Groundwater Modelling, edited by F. Stauffer, W. Kinzelbach, K. Kolvar, and E. Hoehn, IAHS Press

A Course in Time Series Analysis, edited by Daniel Peña, George C. Tiao, and Ruey S. Tsay, Wiley

Design and Analysis in Chemical Research, edited by Roy L. Tranter, CRC Press

Fault Detection and Diagnosis in Industrial Systems, by L. Chiang, E. Russell, and R. Braatz, Springer-Verlag

Generalized, Linear, and Mixed Models, by Charles E. McCulloch and Shayle R. Searle, Wiley

Geometric Data Analysis, by Michael Kirby, Wiley

Geostatistics for Environmental Scientists, by Richard Webster and Margaret A. Oliver, Wiley

The Handbook of Applied Acceptance Sampling, by Kenneth S. Stephens, ASQ Quality Press

Introduction to Statistics and Data Analysis, by Roxy Peck, Chris Olsen, and Jay Devore, Duxbury

Making Hard Decisions (2nd ed.), by Robert T. Clemen and Terence Reilly, Duxbury

Mathematics of Chance, by Jirí Andel, Wiley

Multivariate Analysis of Quality, by Harald Martens and Magni Martens, Wiley

Numerical Methods of Statistics, by John F. Monahan, Cambridge University Press

Optimization Heuristics in Econometrics, by Peter Winker, Wiley

Pattern Classification (2nd ed.), by Richard O. Duda, Peter E. Hart, and David G. Stork, Wiley

Practical Time Series, by Gareth Janacek, Arnold

Principles of Multivariate Analysis, Revised Edition, by W. J. Krzanowski, Oxford University Press

Running Your Machine With SPC, by James C. Abbott, Robert Houston Smith

SAS® System for Regression (3rd ed.), by Rudolf J. Freund and Ramon C. Littell, SAS Institute/John Wiley

Seasonal Adjustment With the X-11 Method, by Dominique Ladiray and Benoît Quenneville, Springer-Verlag

Six Sigma Simplified, by Jay Arthur, LifeStar

Statistical Analysis of Microstructures in Materials Science, by Joachim Ohser and Frank Mücklich, Wiley

Statistical Methods in Spatial Epidemiology, by Andrew B. Lawson, Wiley

Statistical Thinking, by Roger Hoerl and Ronald Snee, Duxbury

Visualizing Categorical Data, by Michael Friendly, SAS Institute

Wavelet Transforms and Time-Frequency Signal Analysis, edited by Lokenath Debnath, Birkhäuser.

http://www.springer.com/978-0-387-98997-6

Statistical Science in the Courtroom
Gastwirth, J.L. (Ed.)
2000, XXII, 443 p., Hardcover
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