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SUGGESTIONS CONCERNING THE PREPARATION OF MANUSCRIPTS FOR THE QUARTERLY OF APPLIED MATHEMATICS

The editors will appreciate the authors' cooperation in taking note of the following directions for the preparation of manuscripts. These directions have been drawn up with a view toward eliminating unnecessary correspondence, avoiding the return of papers for changes, and reducing the charges made for "author's corrections."

Manuscripts: Manuscripts should be typewritten double-spaced on one side only. Marginal instructions to the typesetter should be written in pencil to distinguish them clearly from the body of the text. The author should keep a complete copy.

The papers should be submitted in final form. Only typographical errors should be corrected in proof; composition charges for any major deviations from the manuscript will be passed on to the author.

Titles: The title should be brief but express adequately the subject of the paper. The name and initials of the author should be written as he/she prefers; all titles and degrees or honors will be omitted. The name of the organization with which the author is associated should be given in a separate line following his/her name.

Mathematical Work: As far as possible, formulas should be typewritten; Greek letters and other symbols not available on the average typewriter should be inserted using either instant lettering or by careful insertion in ink. Manuscripts containing pencilled material other than marginal instructions to the typesetter will not be accepted.

The difference between capital and lower-case letters should be clearly shown; care should be taken to avoid confusion between zero (0) and the letter O, between the numeral one (1), the letter l and the prime ($'$), between alpha and a, kappa and k, mu and u, nu and v, eta and n.

The level of subscripts, exponents, subscripts to subscripts, and exponents to exponents should be clearly indicated.

Single embellishments over individual letters are allowed; the only embellishment allowed above groups of letters is the overbar.

Double embellishments are not allowed. These may be replaced by superscripts following the symbols.

Complicated exponents and subscripts should be avoided. Any complicated expression that recurs frequently should be represented by a special symbol.

For exponentials with lengthy or complicated exponents the symbol exp should be used, particularly if such exponentials appear in the body of the text. Thus,

$$\exp[(a^2 + b^2)^{1/2}] \text{ is preferable to } e^{[a^2+b^2]^{1/2}}.$$

Fractions in the body of the text and fractions occurring in the numerators or denominators of fractions should be written with the solidus. Thus,

$$\frac{\cos(x/2b)}{\cos(a/2b)} \text{ is preferable to } \frac{\cos \frac{x}{2b}}{\cos \frac{a}{2b}}.$$

In many instances the use of negative exponents permits saving of space. Thus,

$$\int u^{-1} \sin u \, du \text{ is preferable to } \int \frac{\sin u}{u} \, du.$$

Whereas the intended grouping of symbols in handwritten formulas can be made clear by slight variations in spacing, this procedure is not acceptable in typeset formulas. To avoid misunderstanding, the order of symbols should therefore be carefully considered. Thus,

$$(a + bx)\cos t \text{ is preferable to } \cos t(a + bx).$$

Figures: Figures should be drawn in black ink with clean, unbroken lines; do not use ball point pen. The paper should be of a nonabsorbant quality so that the ink does not spread and produce fuzzy lines. If the figures are intended for reduction, they should be drawn with heavy enough lines so that they do not become flimsy at the desired reduction. The notation should be of professional quality and in proportion for the expected reduction size. Figures that are unsuitable for reproduction will be returned to the author for redrawing. Legends accompanying figures should be written on a separate sheet.

Bibliography: References should be grouped together in a Bibliography at the end of the manuscript. References in text to the Bibliography should be made by numerals between square brackets.

The following examples show the desired arrangements: (*for books* S. Timoshenko, *Strength of Materials*, vol. 2, Macmillan and Co., London, 1931, p. 237; *for periodicals* Lord Rayleigh, *On the flow of viscous liquids, especially in three dimensions*, Phil. Mag. (5) 36, 354 372 (1893)). Note that the number of the series is not separated by commas from the name of the periodical or the number of the volume.

Authors' initials should precede their names rather than follow them.

In quoted titles of books or papers, capital letters should be used only where the language requires this. Thus, *On the flow of viscous fluids* is preferable to *On the Flow of Viscous Fluids*, but the corresponding German title would have to be rendered as *Über die Stromung zaher Flüssigkeiten*.

Titles of books or papers should be quoted in the original language (with an English translation added in parentheses, if this seems desirable), but only English abbreviations should be used for bibliographical details such as ed., vol., no., chap., p.

Footnotes: As far as possible, footnotes should be avoided. Footnotes containing mathematical formulas are not acceptable.

Abbreviations: Much space can be saved by the use of standard abbreviations such as Eq., Eqs., Fig., Sec., Art., etc. These should be used, however, only if they are followed by a reference number. Thus, "Eq. (25)" is acceptable but not "the preceding Eq." Moreover, if any one of these terms occurs as the first word of a sentence, it should be spelled out.

Special abbreviations should be avoided. Thus "boundary conditions" should always be spelled out and not be abbreviated as "b.c." even if this special abbreviation is defined somewhere in the text.

CONTENTS

Vol. LVII, No. 1 **March 1999**

The Formal Semantics of Programming Languages. By Glynn Winskel, The MIT Press, 1993, xx+361 pp., $40.00

This is a volume in the series Foundations of Computing. It introduces the mathematics, techniques and concepts on which formal semantics–a mathematical model for a programming language–rests. It is based on lectures given at Cambridge and Aarhus Universities. It is introductory and primarily addressed to undergraduate and graduate students. It provides the mathematical background necessary for the reader to invent, formalize, and justify rules with which to reason about a variety of programming languages. Several of the topics are, however, drawn from recent research. The book contains many exercises of varying degree of difficulty.

Reality Rules–Picturing the World in Mathematics, Vol. I: The Fundamentals, Vol. II: The Frontier. By John L. Casti, John Wiley and Sons, 1992, xix+388 pp., (Vol. I, chapters 1–4), xx+423 pages (Vol. II, chapters 5–10)

This work explores the syntax and semantics of the language in which the rules of mathematical modeling of reality are written. Its scope is apparent from its chapter headings: 1. The ways of model making: natural systems and formal mathematical representation; 2. Catastrophes, dynamics and life: the singularities of ecological and natural resource systems; 3. Patterns and the emergence of living forms: cellular automata and discrete dynamics; 4. Order in chaos: variety and pattern in the flow of fluids, populations and money; 5. Strategies for survival: competition, games and the theory of evolution; 6. The analytic engine: a system-theoretic view of brains, minds and mechanisms; 7. Taming nature and man: control, anticipation and adaptation in social and biological processes; 8. The geometry of human affairs: connective structure in art, literature and games of chance; 9. The mystique of mechanism: computation, complexity and the limits to reason; 10. How do we know? Myths, models and paradigms in the creation of beliefs.

Numerical Recipes in C-The Art of Scientific Computation, Second Edition. By William H. Press, Saul A. Teukolsky, William T. Vetterling, and Brian P. Flannery, Cambridge University Press, xxvi+994 pp., $49.95

The authors' aim in writing the original edition of *Numerical Recipes* was to provide a book that combined general discussion, analytical mathematics, algorithmics, and actual working programs. This second edition is about 50% larger both in words and in number of included programs (now well over 300). Some of the highlights of the new material in this edition are new chapters or sections on: integral equations and inverse methods; multigrid methods for elliptic p.d.e.'s; band diagonal systems; sparse matrices; Cholesky and QR decompositions; orthogonal polynomials and Gaussian quadratures; numerical derivatives; Padé approximants and rational Chebyshev approximation; Bessel functions and modified Bessel functions of fractional order; improved random number generators; quasi-random sequences; adaptive and recursive Monte-Carlo integration; globally convergent methods for nonlinear equations; simulated annealing; FFT's, wavelet transforms; spectral analysis on unevenly sampled data; Savitzky-Golay smoothing filters; two-dimensional Kolmogorov-Smirnov test; statistical bootstrap method; embedded Runge-Kutta-Fehlberg methods for d.e.'s; stiff d.e.'s; and several others.

Optimization Techniques in Statistics. By Jagdish S. Rustagi, Academic Press, 1994, x+359 pp.

This is a volume in the series Statistical Modeling and Decision Sciences. The author observes that a large variety of statistical problems are essentially solutions to certain optimization problems. He includes in the book not only the techniques of mathematical programming, but also the classical, numerical, as well as modern techniques of optimization, as well as an introduction to the calculus of variations and stochastic approximation. The topics covered are motivated by their applications in modern statistical theory and practice; they include topics such as simulated annealing and Karmarkar's algorithm, made practical through the availability of high-speed computers. Chapter headings: 1. Synopsis; 2. Classical optimization techniques; 3. Optimization and inequalities; 4. Numerical methods of optimization; 5. Linear programming techniques; 6. Nonlinear programming methods; 7. Dynamic programming methods; 8. Variational methods; 9. Stochastic approximation procedures; 10. Optimization in simulation; 11. Optimization in function spaces.

Logistic Regression: A Self-Learning Text. By David G. Kleinbaum, Springer-Verlag, 1994, xiii+282 pp., $49.00

This is a volume in the series Statistics in the Health Sciences. It consists of eight chapters, each of which contains a presentation of its topic in "lecture-book" format together with objectives, an outline, key formulae, practice exercises, and a test. Audio-cassette tapes of each chapter may also be purchased from the author. The text is intended for self-study.

Numerical Modeling of Eddy Currents. By Andrzej Krawczyk and John A. Tegopoulos, Oxford University Press, 1993, viii+116 pp., $37.50

This is an Oxford Science Publication, volume 32 in the series Monographs in Electrical and Electronic Engineering. The authors aim to unify the extensive literature in the subject that has grown up over recent years but is available only in technical journals or is presented at conferences. Chapter headings: 1. Introduction; 2. Continuous model of eddy currents; 3. Methods of numerical analysis; 4. Treatment of special cases; 5. Treatment of nonlinearities; 6. Eddy currents due to motion; 7. Pre- and post-processing.

Permutation Tests—A Practical Guide to Resampling Methods for Testing Hypotheses. By Phillip Good, Springer-Verlag, 1993, x+228 pp., $39.95

This is a volume in the Springer Series in Statistics. This text on the application of permutation tests in biology, medicine, science, and engineering is designed to be used as a reference manual by researchers as well as an intermediate college text for students who have had a first course in statistics. Permutation tests permit a freedom of choice opening up applications that are beyond the reach of conventional parametric statistical inference; they are flexible, robust in the face of missing data and violence of assumptions, and can reduce the cost of experiments and surveys. The 14 chapters have headings such as experimental and balanced designs, multivariate analysis, categorical data, dependence, clustering, increasing computational efficiency, and, finally, theory of permutation tests.

Theoretical Probability for Applications. By Sidney C. Port, John Wiley and Sons, 1994, xviii+894 pp., $95.00

This is a volume in the Wiley Series in Probability and Mathematical Statistics. It attempts to set forth those aspects of the theory that have been found to be most useful in applications to other disciplines, such as statistics. It assumes a knowledge of calculus as well as basic real analysis and linear algebra. The author believes that probability theory cannot be done without the concepts and results of measure theory, and the needed measure-theoretic material is developed as part of the development of probability itself and not as a separate topic. The sixty-two chapters are divided into five parts: 1. Fundamentals of probability theory; 2. Discrete models; 3. Nondiscrete models; 4. Multivariate normal models; 5. Limit concepts; there are 16 appendices covering background material. Taken together, Parts 1 and 5 provide all the material needed to pursue further theoretical study in probability theory per se, such as various topics in stochastic processes, as well as various applications. Parts 2–4 give most of the basic probability models that involve only a finite or countably infinite number of random variables. Most chapters conclude with a number of exercises, many presented with hints and guides to their solution.

Bayesian Theory. By José M. Bernardo and Adrian F. M. Smith, John Wiley and Sons, 1994, xiv+586 pp., $84.95

This is a volume in the Wiley Series in Probability and Mathematical Statistics. It is the first volume of a related series of three: *Bayesian Theory, Bayesian Computation,* and *Bayesian Methods.* The second volume will be written by Alan E. Gelfand and Adrian F. M. Smith, and the third volume by the present authors. The original motivation for this enterprise stemmed from the impact and influence of de Finetti's two-volume *Theory of Probability.* The authors decided to write a series of books that would continue where de Finetti left off, since de Finetti had barely touched the mechanics of Bayesian inference. This first volume attempts to provide a fairly complete and up-to-date overview of the key concepts, results, and issues. There are six chapters: 1. Introduction; 2. Foundations; 3. Generalizations; 4. Modeling; 5. Inference; 6. Remodeling. Chapter 1 gives a brief historical introduction to Bayes' theorem and its author and an overview of the material to be covered in the book. In Chapter 2 the concept of rationality is explored in the context of representing beliefs or choosing actions in situations of uncertainty. An axiomatic basis is introduced for the foundations of decision theory, in the context of which probability and utility are defined. Statistical inference is viewed as a particular decision problem. The logarithmic score is established as the natural utility function. In chapter 3, the ideas and results of chapter 2 are extended to a much more general mathematical setting. Chapter 4 examines in detail the role of familiar mathematical forms of statistical models and the possible justifications—from a subjectivist perspective—for their use as representations of actual beliefs about observable random quantities. In chapter 5 the key role of Bayes' theorem in the updating of beliefs about observables in the light of new information is identified and related to conventional mechanisms of predictive and parametric inference. The roles of sufficiency, ancillarity, and stopping rules in such inference processes are also examined. It is argued in chapter 6 that whether viewed from the perspective of a sensitive individual modeller, or from that of a group of modellers, there are good reasons for systematically entertaining a range of possible belief models, and a variety of decision problems are examined within this framework.

Summaries of the main univariate and multivariate probability distributions appearing in the text are collected in an appendix. In a second appendix, the authors review what they perceive to be the main alternatives to the Bayesian approach, namely classical decision theory, frequentist procedures, likelihood theory, and fiducial and related theories. These alternatives are compared and contrasted in the context of point and interval estimation and hypothesis and significance testing. An extensive Bayesian reading list and a bibliography of about 1500 items are also provided.

Random Coefficient Models. By Nicholas T. Longford, Oxford University Press, 1994, x+270 pp., $45.00

This Oxford Science Publication is volume 11 in the Oxford Statistical Science Series. Its principal aim is an exposition of methods for the analysis of clustered observations; a secondary aim is to provide substantive examples in which between-cluster variation is of substantive interest as a measure of uncertainty, quality, equity, or, generally, as a summary of differences among experimental or observational units. Chapter headings: 1. Introduction; 2. Analysis of covariance with random effects; 3. Examples. Random-effects models; 4. Random regression coefficients; 5. Examples using random coefficient models; 6. Multiple levels of nesting; 7. Factor analysis and structural equations; 8. GLM with random coefficients; 9. Appendix. Asymptotic theory.

Multivariate Statistical Modeling Based on Generalized Linear Models. By Ludwig Fahrmeir and Gerhard Tutz, Springer-Verlag, 1994, xxiv+425 pp., $49.00

This is a volume in the Springer Series in Statistics. It is its aim to bring together and review recent advances in statistical modeling that have grown up around generalized linear models but often are no longer GLM's in the original sense. Although the continuous case is sketched, the focus is on categorical data. Regression analysis is dealt with in a wider sense, including not only cross-sectional analysis but also time series and longitudinal data situations. The estimation approach primarily considered is likelihood-based. The book is written on an intermediate mathematical level with emphasis on basic ideas, and is addressed to applied statisticians, graduate students of statistics, and students and researchers with a strong interest in statistics and data analysis from areas such as econometrics, biometrics, and the social sciences. In preliminary versions of this book, Wolfgang Hennevogl was the third author. Chapter headings: 1. Introduction; 2. Modeling and analysis of cross-sectional data: a review of univariate GLM's; 3. Models for multicategorical responses: multivariate extensions of GLM's; 4. Selecting and checking models; 5. Semi- and nonparametric approaches to regression analysis; 6. Fixed parameter models for time series and longitudinal data; 7. Random effects models; 8. State space models; 9. Survival models.

Tools for Statistical Inference—Methods for the Exploration of Posterior Distributions and Likelihood Functions, Second Edition. By Martin A. Tanner, Springer-Verlag, 1993, ix+156 pp., $39.95

This is a volume in the Springer Series in Statistics. It provides a unified introduction to a variety of computational algorithms that can be used as part of a Bayesian (posterior) analysis or as part of a likelihood analysis. These algorithms can be categorized in several ways: (i) the Newton-Raphson, *EM* (expectation maximization), and Monte Carlo *EM* algorithms, which are used to locate the mode or modes of the likelihood function or the posterior density; (ii) random vs. deterministic algorithms, i.e., non-Monte Carlo (e.g., Newton-Raphson, *EM*, and Laplace), noniterative Monte Carlo (e.g., importance sampling and rejection/acceptance algorithms), and iterative Monte Carlo methods (e.g., Monte Carlo *EM*, data augmentation, Gibbs sampler, Metropolis algorithm); (iii) augmentation vs. nonaugmentation algorithms (e.g., in *EM*, Monte Carlo *EM*, and data augmentation algorithms, the data analyst augments the observed data with latent data to simplify the computations in the analysis). These are all discussed under the following chapter headings: 1. Introduction; 2. Normal approximations to likelihoods and to posteriors; 3. Nonnormal approximations to likelihoods and to posteriors; 4. The *EM* algorithm; 5. The data augmentation algorithm; 6. Markov chain Monte Carlo: the Gibbs sampler and Metropolis algorithm.

Continuous Univariate Distributions, Volume 1, Second Edition. By Norman L. Johnson, Samuel Kotz, and N. Balakrishnan, John Wiley and Sons, 1994, $75.00

This is a volume in the Wiley Series in Probability and Mathematical Statistics. It is a continuation of the second edition of *Univariate Discrete Distributions* and the first of two volumes to discuss continuous univariate distributions. The second edition differs from the first, published in 1970, in that a third author has joined the team, in that the chapter on extreme value distributions was moved to the second volume, and in that the chapter on gamma distributions was split into two. Chapter headings: 12. Continuous Distributions (General), 13. Normal Distributions; 14. Lognormal Distributions; 15. Inverse Gaussian (Wald) Distributions; 16. Cauchy Distributions; 17. Gamma Distributions; 18. Chi-square Distributions Including Chi and Rayleigh; 19. Exponential Distributions; 20. Pareto Distributions; 21. Weibull Distributions.

Outliers in Statistical Data, Third Edition. By Vic Barnett and Toby Lewis, John Wiley and Sons, 1994, $79.95

This is a volume in the Wiley Series in Probability and Mathematical Statistics. The first edition was published in 1978. Since the second, 1984, edition 1000 new refereed publications have appeared in the literature. The authors have thoroughly revised and updated the material. The 13 chapters are divided into four parts: basic principles, univariate data, multivariate and structured data, and special topics. The chapter headings are: 1. Introduction; 2. Why do outlying observations arise and what should one do about them?; 3. The accommodation approach: robust estimation and testing; 4. Testing for discordancy: principles and criteria; 5. Accommodation procedures for univariate samples; 6. Specific discordancy tests for outliers in univariate samples; 7. Outliers in multivariate data; 8. The outlier problem for structured data: regression, the linear model and designed experiments; 9. Bayesian approaches to outliers; 10. Outliers in time series, an important area of outlier study; 11. Outliers in directional data; 12. Some little-explored areas: contingency tables and sample surveys; 13. Important strands: computer software data studies, standards and regulations; 14. Perspective.

Modern Applied Statistics with S-Plus. By W. N. Venables and B. D. Ripley, Springer-Verlag, 1994, xiv+462 pp., $39.00

This is a volume in the series Statistics and Computing. Its aim is to show how to analyze data sets using the statistical system S-plus. It is not a text in statistical theory, but does cover modern statistical methodology. It shows how S can be used and how the availability of a powerful graphical system can alter the way we approach data analyses. The chapters on applying S to statistical problems are largely self-contained. The chapter headings are: 1. Introduction; 2. The S language; 3. Graphical output; 4. Programming in S; 5. Distributions and data summaries; 6. Linear statistical models; 7. Generalized linear models; 8. Robust statistics; 9. Non-linear regression models; 10. Modern regression; 11. Survival analysis; 12. Multivariate analysis; 13. Tree-based methods; 14. Time series; 15. Spatial statistics.

The Statistical Analysis of Time Series. By T. W. Anderson, John Wiley and Sons, 1994, xiv+704 pp., $44.95

This volume in the *Wiley Classics Library* is a paperback reprint of the well-known classic first published in 1971.

Models for Repeated Measurements. By J. K. Lindsey, Oxford University Press, 1993, xiv+412 pp., $56.95

This is a volume in the Oxford Statistical Science Series. It assumes the reader to be familiar with the basic methods of discrete data and survival analysis. Knowledge of stochastic processes is also useful, but not essential. The intent of the author has been to provide methods and examples that may form a basis from which a research worker can proceed. For this reason an extensive bibliography of 1382 items has been included. The chapter headings are: 1. Basic concepts; 2. Fundamentals of modeling; 3. heterogeneous populations; 4. Longitudinal studies; 5. Overdispersion; 6. Longitudinal discrete data; 7. Frailty; 8. Event histories. Chapters 1 and 2 make up the introduction, chapters 3 and 4 concern normal distribution models, chapters 5 and 6 describe models for categorical data, and chapters 7 and 8 treat models for duration data.

The Bayesian Choice. A Decision-Theoretic Motivation. By Christian P. Robert, Springer-Verlag, 1994, xiv+436 pp., $49.00

This is a volume in the series Springer Texts in Statistics. It has its origins in a translation from a French version. It builds on very few prerequisites in statistics and only requires basic skills in calculus, measure theory, and probability. It goes far enough, however, to cover advanced topics and modern developments in Bayesian statistics, such as complete class theorems, the Stein effect for spherically symmetric distributions, multiple shrinkage, loss estimation, decision theory for testing and confidence regions, hierarchical and empirical modeling, Gibbs sampling, etc., whilst motivating the theoretical appeal of the Bayesian approach on decision-theoretic justifications. Chapter 1 is an introduction to statistical models, including the Bayesian model and some connections with the likelihood principle. Chapter 2 (Decision-Theoretic Foundations of Statistical Inference) considers decision theory from a classical point of view. Chapter 3 (From Prior Information to Prior Distributions) gives the corresponding analysis for prior distributions and deals in detail with conjugate priors and their mixtures, and noninformative priors. Classical statistical models are studied in chapter 4 (Bayesian Point Estimation), paying particular attention to normal models and their relation to linear regression. Tests and confidence regions are studied separately in chapter 5. The second part of the book dwells on more advanced topics. Chapter 6 (Admissibility and Complete Classes) covers complete class results and sufficient/necessary admissibility conditions. Chapter 7 (Invariance, Haar Measures, and Equivariant Estimators) introduces the notion of invariance and its relation to Bayesian statistics, including a heuristic section on the Hunt-Stein theorem. Hierarchical and empirical extensions of the Bayesian approach, including some developments on the Stein effect, are treated in Chapter 8. Chapter 9 (Bayesian Calculations) constitutes an introduction to state-of-the-art computational methods (Laplace, Monte-Carlo and, mainly, Gibbs sampling). Chapter 10 (A Defense of the Bayesian Choice) is a more personal conclusion on the advantages of Bayesian theory, also confronting the most common criticisms of the Bayesian approach.

Applied Econometric Time Series. By Walter Enders, John Wiley and Sons, 1994, 433 pp., $55.95

This is a volume in the Wiley Series in Probability and Mathematical Statistics. It is intended for students with some background in multiple regression analysis. The examples in the text provide a balance between the application of time-series to macroeconomics and to microeconomics. To work through the exercises it is necessary to have access to a statistical software package. Chapter headings: 1. Difference equations; 2. Stationary time-series models; 3. Modeling economic time series: trends and volatility; 4. Testing for trends and unit roots; 5. Multiequation time-series models; 6. Cointegration and error-correction models.