

QUARTERLY  
OF  
APPLIED MATHEMATICS

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VOLUME LXII

MARCH • 2004

NUMBER 1

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## Quarterly of Applied Mathematics

The *Quarterly of Applied Mathematics* prints original papers in applied mathematics which have an intimate connection with applications. It is expected that each paper will be of a high scientific standard; that the presentation will be of such character that the paper can be easily read by those to whom it would be of interest; and that the mathematical argument, judged by the standard of the field of application, will be of an advanced character.

In accordance with their general policy, the Editors welcome particularly contributions which will be of interest both to mathematicians and to scientists or engineers. Authors will receive galley proof only. The author's institution will be requested to pay a publication charge of \$30 per page to support production costs which, if honored, entitles the author to 100 free offprints. Detailed instructions will be sent with galley proofs.

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This journal is indexed in *Mathematical Reviews*, *Zentralblatt MATH*, *Science Citation Index*<sup>®</sup>, *Science Citation Index*<sup>TM</sup>-Expanded, *ISI Alerting Services*<sup>SM</sup>, *CompuMath Citation Index*<sup>®</sup>, *Current Contents*<sup>®</sup>/*Engineering, Computing & Technology*. It is also indexed by *Applied Science & Technology Index* and abstracted by *Applied Science & Technology Abstracts*.

Periodicals postage paid at Providence, Rhode Island.

Publication number 808680 (ISSN 0033-569X)

Printed in the United States of America.

The paper used in this journal is acid-free and falls within the guidelines established to ensure permanence and durability.

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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."

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### Submission of Accepted Manuscripts:

Submission of electronically-prepared manuscripts is encouraged, with a strong preference for  $\mathcal{A}\mathcal{M}\mathcal{S}$ - $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$ . To assist authors in preparing electronic manuscripts, the AMS has prepared author packages. The author package includes instructions for preparing electronic manuscripts, the *AMS Author Handbook*, samples, graphic creation instructions, and a style file. Though  $\mathcal{A}\mathcal{M}\mathcal{S}$ - $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$  is the highly preferred format of  $\mathcal{T}\mathcal{E}\mathcal{X}$ , an author package is also available in  $\mathcal{A}\mathcal{M}\mathcal{S}$ - $\mathcal{T}\mathcal{E}\mathcal{X}$ . When choosing a style file for the *Quarterly of Applied Mathematics*, choose the generic journal package, made available by the American Mathematical Society at [www.ams.org/tex/author-info.html](http://www.ams.org/tex/author-info.html). For more technical information, please visit [www.ams.org/authors/author-faq.html](http://www.ams.org/authors/author-faq.html).

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 *Quarterly of Applied Mathematics*. When it is not possible to electronically prepare a manuscript, the manuscript should be typeset or typewritten double-spaced on one side only and figures should be drawn with black India ink on glossy white paper. Please note that an electronically-prepared manuscript moves much more swiftly through the production process than does a typewritten paper.

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### Electronic Graphics:

Comprehensive instructions on preparing graphics are included in PDF format in the author package. Submit files for graphics as EPS (Encapsulated PostScript) files. This includes graphics originating via a graphics application as well as scanned photographs or other computer-generated images. If this is not possible, TIFF files are acceptable as long as they can be opened in Adobe Photoshop or Illustrator. No matter what method is used to produce the graphics, it is necessary to provide a paper copy to the AMS.

Authors using graphics packages for the creation of electronic art should avoid the use of any lines thinner than 0.5 points in width at 100%. Many graphics packages allow the user to specify a "hairline" for a very thin line. Hairlines often look acceptable when proofed on a typical laser printer. However, when produced on a high-resolution laser imagesetter, hairlines become nearly invisible and will be lost entirely in the final printing process.

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0033-569X(200403)62:1;1-0

*Methods and Applications of Linear Models—Regression and the Analysis of Variance.* By Ronald R. Hocking, John Wiley and Sons, 2003, xxi+741 pp., \$99.95

This is the second edition of a volume in the Wiley Series in Probability and Statistics, first published in 1996. It presents a thorough treatment of the concepts and methods of linear model analysis and illustrates them with numerical and conceptual examples. The essential change is that the development of the statistical distribution and inference theory for regression models has been moved to the end of the book as Part III, so that readers can concentrate on the methodology of Parts I and II and leave the theoretical developments until they have been motivated by practical methods. References to the formal development in Part III are given in the methodological sections. Also, about one hundred exercises have been added in this edition; a solutions manual for them is available from the author. Table of contents: Part I. Regression Models. 1. Introduction to linear models; 2. Regression on functions of one variable; 3. Transforming the data; 4. Regression on functions of several variables; 5. Collinearity in multiple linear regression; 6. Influential observations in multiple linear regression; 7. Polynomial models and qualitative predictors; 8. Additional topics (non-linear regression models, non-parametric model-fitting methods, logistic regression, random input variables, errors in the inputs, calibration). Part II: Analysis of Variance Models. 9. Introduction to ANOVA models; 10. Fixed effects models I: one-way classification of means; 11. Fixed effects models II: two-way classification of means; 12. Fixed effects models III: multiple crossed and nested factors; 13. Mixed models I: the AOV method with balanced data; 14. Mixed models II: the AVE method with balanced data; 15. Mixed models III: unbalanced data. Part III: Mathematical Theory of Linear Models. 16. Distribution of linear and quadratic forms; 17. Estimation and inference for linear models; 18. Simultaneous inference: tests and confidence intervals. There are two appendices on mathematical and statistical background items, respectively.

*Generalized Estimating Equations.* By James W. Hardin and Joseph M. Hilbe, Chapman and Hall/CRC, 2003, ix+222 pp., \$69.95

General estimating equations (GEE) extends the basic generalized linear model (GLM) algorithm to incorporate the modeling of longitudinal (correlated) and clustered data. The reader should have a basic understanding of GLM but a review of the subject is provided. The text provides an overview of the GEE methodology in all its variations (some of which vary from the GLM approach), as well as to compare it with other methods used to model correlated and clustered data. The text is organized into four chapters with a fifth listing data and useful programs. The first chapter provides an introduction to the subject matter. The second chapter offers a historical perspective on the development of GLM methodology, and reviews basic modeling strategies focusing on the nature and scope of the estimating equations. Panel data are introduced and appropriate likelihood-based methods discussed. Chapter 3 concentrates on the varieties of GEE's, comparing the different types of GEE models. The main division is between marginal or population averaging models and subject specific models. Chapter 4 deals with residual analysis and model goodness of fit, demonstrating many graphical and statistical techniques applicable to GEE analysis. The programs in the fifth chapter use Stata, SAS, S-Plus, and SUDAAN. Real-life and simulated datasets complete the chapter. The bibliography contains about 100 items.

*Statistical Methods for Survival Data Analysis.* By Elisa T. Lee and John Wenyu Wang, John Wiley and Sons, 2003, xii+513 pp., \$89.95

This is the third edition of a volume in the Wiley Series in Probability and Statistics. It is intended to provide a comprehensive introduction to the most commonly used parametric and nonparametric methods for analyzing survival data. The third edition continues to be application-oriented, with a minimum level of mathematics required. The two chapters on clinical trials in the second edition have been omitted. Among the improvements in this edition are the following: the addition of the log-logistic distribution and a generalized gamma distribution for model fitting; addition of asymptotic likelihood inference of methods covered in several chapters; the Cox-Snell residual method for graphical survival distribution fitting; BIC and AIC procedures for goodness of fit tests; additions to Cox's proportional hazards model; nonproportional hazards models; linear logistic regression is expanded for polychotomous outcomes; codes for BMDP, SAS, and SPSS are provided for most examples. Chapter headings: 1. Introduction; 2. Functions of survival time; 3. Examples of survival data analysis; 4. Nonparametric methods for estimating survival functions; 5. Nonparametric methods for comparing survival distributions; 6. Some well-known parametric survival distributions and their applications; 7. Estimating procedures for parametric survival distributions without covariates; 8. Graphical methods for survival distribution fitting; 9. Tests of goodness of fit and distribution selection; 10. Parametric methods for comparing two survival distributions; 11. Parametric methods for regression model fitting and identification of prognostic factors; 12. Identification of prognostic factors related to survival time: Cox proportional hazards model; 13. Identification of prognostic factors related to survival time: nonproportional hazards model; 14. Identification of risk factors related to dichotomous and polychotomous outcomes.

*Wind-Waves in Oceans—Dynamics and Numerical Simulations.* By Igor V. Lavrenov, Springer-Verlag, 2003, xi+376 pp., \$129.00

This is a volume in the series Physics of Earth and Space Environments. It considers wind waves in terms of the most general formulation of the problem as a stochastic hydrodynamic process with wide spatial variability. It ranges from the global scale of the oceans, whose typical size is comparable to the earth's radius, to the regional and local scales of the seas, including water areas limited in space, with significant current and depth gradients in coastal zones, where waves end, having travelled tens of thousands of miles. The models include spatial non-uniformity, taking into account currents, uneven bottoms, and ice, which influence the generation, evolution, and propagation of wind waves. The monograph constitutes the first systematic presentation of the modern theory, including recent progress. Chapter headings: 1. General problem formulation of wind wave modelling in a non-uniform ocean; 2. Mathematical simulation of wave propagation at global distances; 3. Numerical implementation of the wave energy balance equation; 4. Study of physical mechanisms forming the wind wave energy spectrum in deep water; 5. Wave evolution in non-uniform currents in deep water; 6. Wave transformation in shallow water; 7. Wave transformation in ice-covered water.

*Quantitative Methods in Population Health—Extensions of Ordinary Regression.* By Mari Palta, Wiley-Interscience, 2003, xxvi + 311 pp., \$89.95

This is a volume in the Wiley Series in Probability and Statistics. The text assembles the information the author has seen investigators need most often in the course of several long-term population-based observational studies. The material is kept immediately applicable by the provision of detailed instructions on how to run and interpret procedures in SAS. The beginning chapters lay the mathematical groundwork necessary for topics in later chapters and, in addition, each topic starts with an explanation of the theoretical background necessary for judging when the technique presented is applicable. Chapter headings: 1. Review of ordinary linear regression and its assumptions; 2. The maximum likelihood approach to ordinary regression; 3. Reformulating ordinary regression analysis in matrix notation; 4. Variance matrices and linear transformations; 5. Variance matrices of estimators of regression coefficients; 6. Dealing with unequal variance around the regression line; 7. Application of weighting with probability sampling and nonresponse; 8. Principles in dealing with correlated data; 9. A further study of how the transformation works with correlated data; 10. Random effects; 11. The normal distribution and likelihood revisited; 12. The generalisation to non-normal distributions; 13. Modeling binomial and binary outcomes; 14. Modeling Poisson outcomes—the analysis of rates; 15. Modeling correlated outcomes with generalized estimating equations.

*Order Statistics.* By H. A. David and N. Nagaraja, Wiley-Interscience, 2003, xv + 458 pp., \$94.95

This is the third edition of a volume in the Wiley Series in Probability and Statistics, first published in 1969, with the second edition in 1980. It presents in detail an up-to-date account of the basic results of the subject. The number of references has increased from 1000 in the second edition to around 1500, in spite of the elimination of many references cited earlier. Chapters 2–9 deal with finite sample theory, with distribution theory in chapters 2–6 and statistical inference in chapters 7–9. Asymptotic theory is covered in chapters 10 and 11, representing a doubling in coverage. In addition to this increased emphasis on asymptotic theory and on order statistics in other than random samples (chapter 5), many sections are entirely or largely new. For instance, section 6.6 includes a major application to median and order-statistic filters and section 9.6 to bioequivalence testing. Chapter headings: 1. Introduction; 2. Basic distribution theory; 3. Expected values and moments; 4. Bounds and approximations for moments of order statistics; 5. The non-iid case; 6. Further distribution theory; 7. Order statistics in nonparametric inference; 8. Order statistics in parametric inference; 9. Short-cut procedures; 10. Asymptotic theory; 11. Asymptotic results for functions of order statistics. In an appendix there is a guide to tables and algorithms, but not to software.

*Interest Rates, Insurance, Social Security, and Pensions.* By Robert Muksian, Prentice Hall, 2003, xii+349 pp.

This text provides an elementary introduction to some of the mathematics of actuarial science. It will be useful to students in introductory business school courses and to the general reader interested in the subjects treated. Chapter headings: 1. Simple interest and discount; 2. Practical applications using simple interest; 3. Compound interest; 4. Basic annuities; 5. Other annuities; 6. Bond valuation; 7. Elements of linear programming; 8. Breakeven models; 9. Life insurance; 10. Social security; 11. Private pensions.

*Introduction to Bioinformatics—A Theoretical and Practical Approach.* Edited by Stephen A. Krawetz and David D. Womble, Humana Press, 2003, ix+746 pp., \$135.00 (hardcover), \$89.50 (paperback)

This text provides a mathematician, statistician, or computer scientist with a biological framework for understanding the problems tackled by a life scientist in the context of the computational issues and currently available tools. At the same time, it provides the life scientist with a source for the various computational tools now available, together with an introduction to their underlying mathematical foundations. The 36 chapters are divided into four main sections. The first section describes basic cellular structure and the biological decoding of the genome, also explaining *in silico* detection of the promoter elements that modulate genome decoding. The second section discusses the long range regulation of genomes, the *in silico* detection of the elements that impact long range control, and the molecular genetic basis of disease as a consequence of replication. The third section is designed to enable the life scientist (and others) to become as comfortable in the command line environment of the *UNIX* operating system as in the Graphical-User Interface environment. The fourth section, devoted to *Computer Applications*, presents an account of the management and analysis of DNA sequencing projects, along with a review of how DNA can be modeled as a statistical series of patterns. There is a CD supplement which contains a complete set of illustrations from each chapter, many in color, as well as several full versions and limited trial versions of the programs discussed in the text. The chapters are divided as follows: Part I. Biochemistry, Cell, and Molecular Biology: A. The Cell (3 chapters), B. Transcription and Translation (2 chs.). Part II. Molecular Genetics: A. Genomics (4 chs.), B. Clinical Human Genetics (3 chs.). Part III. The UNIX Operating System: A. Basics and Installation (3 chs.), B. Managing Bioinformatics Tools (2 chs.), C. Command Line Sequence Analysis (2 chs.). Part IV. Computer Applications: A. Management and Analysis of DNA Sequencing Projects (5 chs.), B. The Genome Database: Analysis and Similarity Searching (4 chs.), C. Identifying Functional and Structural Sequence Elements (4 chs.), D. Analysis of Gene Expression: Microarrays and Other Tools (3 chs.). Part V. Appendices.



*Statistical Size Distributions in Economics and Actuarial Science.* By Christian Kleiber and Samuel Kotz, Wiley-Interscience, 2003, xi+332 pp., \$94.95

This is a volume in the Wiley Series in Probability and Statistics. It traces the numerous statistical models of income distribution from Pareto's model in the late 19th century to the latest ones. The authors' goal is to review, compare, and connect all these models, pointing out the duplication of effort that resulted. They also discuss the size distributions of loss in actuarial applications. Chapter headings: 1. Introduction; 2. General principles; 3. Pareto distributions; 4. Lognormal distributions; 5. Gamma-type size distributions; 6. Beta-type size distributions; 7. Miscellaneous size distributions. There are appendices on size distributions and on biographies (Pareto, Benini, Lorenz, Gini, Amoroso, Gibrat, Champernowne), and a bibliography of over 600 items.

*Exploration and Analysis of DNA Microarray and Protein Array Data.* By Dhammika Amaratunga and Javier Cabrera, Wiley-Interscience, 2003, xiv+246 pp., \$84.95

This is a volume in the Wiley Series in Probability and Statistics. The data from a DNA microarray experiment is a series of scanned images of microarrays. Analyzing them involves converting the images into quantitative data, then preprocessing the data to transform them into a form suitable for analysis and finally applying appropriate data analysis techniques to extract information pertinent to the biological question under study. As these experiments can be run on replicate samples, application of statistical methodology is feasible. The purpose of this book is to present an extensive series of computational, visual, and statistical tools that are being used for exploring and analyzing microarray data, after providing a review of basic molecular biology and an introduction to microarrays and their preparation. Chapter headings: 1. A brief introduction; 2. Genomics basics; 3. Microarrays; 4. Processing the scanned image; 5. Preprocessing microarray data; 6. Summarization; 7. Two-group comparative experiments; 8. Model-based inference and experimental design considerations; 9. Pattern discovery; 10. Class prediction; 11. Protein arrays. There is a bibliography of over 300 items.

*Statistical Methods for Rates and Proportions.* By Joseph L. Fleiss, Bruce Levin, and Myunghee Cho Paik, Wiley-Interscience, 2003, xxvii+760 pp., \$94.95

This is the third edition of a volume in the Wiley Series in Probability and Statistics, first published in 1972, with the second edition in 1980. The authors' approach has been to leave much of the original material intact with clarifications, corrections, and streamlining, while covering new material at two levels. The first introduces methods with only as much complexity as is required to give a clear presentation. The second is aimed at students of biostatistics and specialists in data analysis, and requires a level of mathematical preparation equivalent to a first and second course in statistics. Many numerical and theoretical problems have been added, with answers to selected problems given in an appendix. The preference for frequentist methods is generally maintained, but in key places the authors take an empirical Bayes approach. New material includes new chapters on binary and polytomous logistic regression, on Poisson regression models for matched samples, on the analysis of correlated binary data, and on methods for analyzing fourfold tables with missing data, and new material is added at many other places, integrated with the old. Chapter headings: 1. An introduction to applied probability; 2. Statistical inference for a single proportion; 3. Assessing significance in a fourfold table; 4. Determining sample sizes needed to detect a difference between two proportions; 5. How to randomize; 6. Comparative studies: cross-sectional, naturalistic, or multinomial sampling; 7. Comparative studies: prospective and retrospective sampling; 8. Randomized controlled trials; 9. The comparison of proportions from several independent samples; 10. Combining evidence from fourfold tables; 11. Logistic regression; 12. Poisson regression; 13. The analysis of data from matched samples; 14. Regression models for matched samples; 15. Analysis of correlated binary data; 16. Missing data; 17. Misclassification: effects, control, and adjustment; 18. The measurement of interrater agreement; 19. The standardization of rates.

*Weibull Models.* By D. N. Prabhakar Murthy, Min Xie, and Renyan Jiang, Wiley-Interscience, 2004, xvi+383 pp., \$99.95

This is a volume in the Wiley Series in Probability and Statistics. Its aims are to integrate the disjointed literature on Weibull models by developing a proper taxonomy for the classification of such models, to review the literature dealing with the analysis and statistical inference for the different Weibull models, to discuss the usefulness of the Weibull probability paper plot in model selection to model a given data set, and to highlight the use of Weibull models in reliability theory. The 18 chapters are divided into seven parts: A: Overview; B. Basic Weibull models; C. Types I and II models; D. Type III models; E. Types IV to VII models; F. Weibull modelling of data; G. Applications to reliability.

*Statistical Methods for Survival Data Analysis.* By Elisa T. Lee and John Wenyu Wang, Wiley-Interscience, 2003, xii+513 pp., \$89.95

This is the third edition of a volume in the Wiley Series in Probability and Statistics. Because of the many recent books on the subject, the two chapters on clinical trials that were in the second edition have been deleted, and the following features, amongst others, added: the log-logistic and generalized gamma distributions and their applications; discussions of asymptotic likelihood inference; the Cox-Snell residual methods for survival distribution fitting; the BIC and AIC tests of goodness of fit tests; more on Cox's proportional hazard model and the concept of nonproportional hazards; regression models for polychotomous outcomes, and computer programming codes for software packages BMDP, SAS, and SPSS (but not S-Plus!) are provided for most examples in the text. Chapter headings: 1. Introduction; 2. Functions of survival time; 3. Examples of survival data analysis; 4. and 5. Nonparametric methods of estimating survival function, and for comparing survival distributions, respectively; 6. Some well-known parametric survival distributions and their applications; 7. Estimation procedures for parametric survival distributions without covariates; 8. Graphical methods for survival distribution fitting; 9. Tests of goodness of fit and distribution selection; 10. and 11. Parametric methods for comparing two survival distributions, and for regression model fitting and identification of prognostic factors, respectively; 12. and 13. Identification of prognostic factors related to survival time: Cox proportional hazards models, and nonproportional hazards models, respectively; 14. Identification of risk factors related to dichotomous and polychotomous outcomes.

*Leslie Kish: Selected Papers.* By Graham Kalton and Steven Heeringa, editors, Wiley-Interscience, 2003, xii+356 pp.

This is a volume in the Wiley Series in Probability and Statistics. The 17 articles in this collection are divided into six groups: 1. Role of probability sampling in scientific research; 2. Applied sampling methods; 3. Issues in inference from survey data; 4. Nonsampling errors; 5. Domain estimation; 6. Professional leadership and training. All groups are preceded by detailed introductions, commenting on each paper and putting it into the context of other work in the field. There is a bibliography of about 450 items.