ENCyclopedia OF ENVIRONMENTICS

Subject Areas (editors):
- Chemometrics (C. Spigelman)
- Ecological Statistics (J. Verhoef)
- Environmental Health (L. Ryan)
- Environmental Policy and Regulation (L. Cox)
- Extremes and Environmental Risk (J. Teugels)
- Natural Resources and Agriculture (T. G. Gregoire)
- Hydrological and Physical Processes (P. Chatwin and P. Sullivan)
- Spatial/Temporal Modeling and Analysis (P. Guttorp)
- Statistical and Numerical Computing (G. Hørst)
- Stochastic Modeling and Environmental Change (D. Brillinger)
- Statistical Theory and Methods (J. Zidek)

Readership: Any student or researcher interested in quantitative methods for the analysis and evaluation of environmental systems.

The success of Wiley’s Encyclopedia of Statistical Science, published during the 1980s, has led to several spin-offs, including the six-volume Encyclopedia of Biostatistics in 1998, and some recent one-volume reference works, all sharing a common format. The present Encyclopedia has 530 entries, each briefly surveying a topic and providing a list of key literature references and cross-references to related articles. The average article length is just over four pages; most are shorter, while there are long articles on Atmospheric Dispersion (45 pages spread over four entries), Risk (50 pages in six entries), Extreme Value Analysis (21 pages), Graphical Displays (27) and Environmental Sampling (23).

Very roughly three-quarters of the material might be regarded as statistics. Much of this is generic, and since environmental applications embrace such a wide range of statistical methods, the Encyclopedia can serve as a general reference work on statistical methods. For example, the article on Stochastic Processes gives a very general reference to related articles. The average article length is just over four pages; most are shorter, while there are long articles on Atmospheric Dispersion (45 pages spread over four entries), Risk (50 pages in six entries), Extreme Value Analysis (21 pages), Graphical Displays (27) and Environmental Sampling (23).

The remaining articles cover non-stochastic mathematics (e.g. Fractal Dimension), environmental science (e.g. lakes, deforestation, fisheries, forestry, meteorology), economics and policy issues and some key (mainly US) legislation, professional/scientific societies, journals, agencies (affiliated with the United Nations, the European Union, or the US Government), and software (S-PLUS and SAS, but not the widely-used freeware R and BUGS).

Although the Encyclopedia is international in scope, it is centred in North America: the eleven of fourteen editors are based there, as are about two thirds of the contributors, which reflects the North American dominance of the field.

This is an excellent resource for its targeted audience. Unfortunately its price will prevent it being on the personal bookshelf of most envirormetrics researchers, but it is a must for the libraries of institutions which house multiple envirormetrics-related students and researchers. It will be useful for other statistics users in those institutions.

Imperial College of Science, Technology and Medicine
London, U.K.

D.J. Balding


Contents:
1. Introduction: The Origin of the Coordinates
2. The Foundation Problems: 1, 2, 10
3. The Foundations of Specific Areas: 3, 4, 5, 6
4. Number Theory: 7, 8, 9, 11, 12
5. Algebra and Geometry: A. Miscellany: 14, 15, 16, 17, 18
6. The Analysis Problems: 13, 19, 20, 21, 22, 23
7. We Come to Our Census

Readership: Everyone

In 1900, at the Paris International Congress of Mathematicians, David Hilbert delivered a lecture modestly titled “Mathematical Problems”. This historic lecture set the stage and focus for a century of mathematics. In his talk, Hilbert listed ten outstanding problems and later, when the Proceedings of the Congress came out, expanded his list to twenty-three. These problems have since become known as Hilbert’s problems. Not all have been solved, the most notorious being the Riemann hypothesis which is Hilbert’s eighth problem. Only a few have been completely resolved and these too not the way Hilbert had envisioned, such as Cantor’s continuum hypothesis. Solving a single one of Hilbert’s problems puts one in “The Honours Class”, whence the title of this book.

This book is about the story of these problems after more than a century since the epoch-making lecture of Hilbert. Yandell relates the colourful stories behind these problems and gives insightful descriptions of the personalities behind the solutions. The book is partitioned into five sections, classified according to subject. Each section has a gripping narrative of the mathematician. Truly, the book
does much to show that mathematics and mathematicians are living organisms.

Queen’s University Kingston, Canada R. Murty

STATISTICS OF THE GALAXY DISTRIBUTION

Contents:
1. The clumpy universe
2. The standard model of the universe
3. Cosmological point processes
4. Fractal properties of the galaxy distribution
5. Statistical and geometrical models
6. Formation of structure
7. Random fields in cosmology
8. Fourier analysis of clustering
9. Cosmography
10. Structure statistics
APPENDIX A: Co-ordinate transformation
APPENDIX B: Some basic concepts in statistics

Readership: Practising cosmologists, graduate students in cosmology, statisticians with interest in spatial statistics applied to cosmology

Cosmology is an important application of spatial statistics. This book combines the description of methods in spatial statistics with background material on cosmological physics, thus illustrating the application of spatial statistics in cosmology. With extensive references to current literature and websites as well as a large collection of illustrations of statistical methods, physical models and available data, the book provides a compact overview on current statistical practise in cosmology. The book will be a good reference point for the challenge of rapidly increasing availability of cosmological data!

University of Warwick Coventry, U.K. E. Thönnes

STATISTICAL METHODS IN MEDICAL RESEARCH

Contents:
1. The scope of statistics
2. Describing data
3. Probability
4. Analysing means and proportions
5. Analysing variances, counts and other measures
6. Bayesian methods
7. Regression and correlation
8. Comparison of several groups
9. Experimental design
10. Analysing non-normal data
11. Modelling continuous data
12. Further regression models for a continuous response
13. Multivariate methods
14. Modelling categorical data
15. Empirical methods for categorical data
16. Further Bayesian methods
17. Survival analysis
18. Clinical trials
19. Statistical methods in epidemiology
20. Laboratory assays

Readership: Medical research workers, statisticians

This is the fourth edition of one of the standard references in medical statistics. [Short Book Reviews Vol.16, p.1]. The three previous editions have contributed substantially to the formal and informal education of many individuals involved in medical research and, thus, to a wide variety of specific research projects. However, with the proliferation of more recently published books on medical statistics, Statistical Methods in Medical Research is perhaps regarded by some as a classic more than a current standard resource. If so, then it should be the case no longer!

This new edition is a remarkably up to date survey of the statistical methodology used in medical research. It is a thoughtful and substantive revision of the third edition. It retains the wise perspective of earlier editions and extends it to more recent methodological developments. Chapter 12 is a particular ‘tour de force’. While it might be possible to find minor criticisms of some sections, this is a volume which could usefully, and perhaps should, be read from cover to cover by anyone embarking on the study of medical statistics. For those already working in the area, it should at least be on their bookshelves.

Medical Research Council Cambridge, U.K. V.T. Farewell


Contents:
1. Orientation
2. What is causation?
3. Naïve minimal sufficient cause
4. Events and probabilities
5. Unitary algebra
6. Nontrivial implication
7. Tiny examples
8. The one-factor model
9. Graphical elements
10. Causation
11. Structural equations
12. The two-factor model
13. Down’s syndrome example
14. Marginalization
15. Stratification
16. Obesity example
17. Attribution
18. Indirect cause: Probabilities
19. Indirect cause: Structures
20. Reversal
21. Gestational diabetes example
22. More reversal
23. Double reversal
24. Complex indirect cause
25. Dual causation: Probabilities
26. Dual causation: Structures
27. Paradoxical causation
28. Interventions
29. Causal covariance
30. Unitary rates
31. Functional causation
32. The causation operator
33. Causal modelling
34. Dependence
35. DAG theory
36. Epilogue
37. Further reading

Readership: Readers interested in joining the growing band of thinkers turning their attention to the meaning of cause

The study of causation is experiencing something of a boom. This is in a large part a consequence of recent developments in computer technology, such as expert
systems, which have focused attention on the difficulties of identifying causes, initially for purely practical ends. It is perhaps not a coincidence that the examples in the book are from the fields of biomedicine and epidemiology, fields which were at the forefront of the development of expert systems in the 1980s. Aickin argues that a better understanding of causal terms is important if biomedical research is to advance properly. Indeed, he goes so far as to raise the spectre, suggested by the cosmologist John Barrow, that the number of scientific questions raised will exceed society’s ability to pursue answers, so that less and less useful work will be done, unless proper articulation of causal questions is made.

In this book, he adopts a constructivist approach, beginning with an underfined notion of sufficient cause and developing ideas from what he believes are natural properties of this concept, using the work of Mackie on causal equivalence and Rothman on minimal sufficient causes. To a large extent, this direction of work is very different from the directed acyclic graph approach which has attracted much interest in recent years, especially with the work of J. Pearl.

This book represents a valuable addition to the literature on causality, and is likely to be of interest to anyone concerned with this topic.

Imperial College of Science, Technology and Medicine
London, U.K.

D.J. Hand

MATHEMATICS OF GENOME ANALYSIS: J.K. Percus.

Contents:
1. Decomposing DNA
2. Recomposing DNA
3. Sequence statistics
4. Sequence comparison
5. Spatial structure and dynamics of DNA

Readership: Advanced undergraduates and postgraduates in mathematics and statistics, and their teachers

The human genome project has thrown out many fascinating mathematical and statistical challenges, and this short book surveys many of them. One frustrating aspect of the subject is that, as technology develops, problems cease to be of scientific interest. Chapters 1 and 2, dealing with methods for constructing maps of overlapping cloned fragments of DNA, are now largely of historical interest scientifically, but retain their interest as exemplars of mathematical/statistical problem solving. Chapters 3 and 4, dealing respectively with the statistical analysis of individual sequences and the comparisons of distinct sequences, are of continuing importance. Almost all of the “mathematics” is statistical. The author’s style suggests a background in applied mathematics rather than statistics. This results in some use of non-standard notation and terminology, a lack of integration of the problems with standard statistical theory (for example time series analysis), and an implicit error of transposing the conditional at the start of Chapter 4 (a question about the probability of observing the sequence if it is random, without a discussion of the relationship between these different questions). However, these are not fundamental objections, and the author’s competence in the mathematics and experience of the field cannot be challenged. I thought the brief forays into biological background were well-judged and appropriate. Since the problems are almost all easy to state and interesting, this book would be an excellent pedagogical resource, providing problems for advanced undergraduate and postgraduate students. Eight assignments are set, and many more are latent in the text.

Imperial College of Science, Technology and Medicine
London, U.K.  D.J. Balding

INTRODUCTION TO DISTANCE SAMPLING:

Contents:
1. Introductory concepts
2. Assumptions and modelling philosophy
3. Statistical theory
4. Line transects
5. Point transects
6. Related methods
7. Study design and field methods
8. Illustrative examples

Common and scientific names of plants and animals

Readership: Statisticians and quantitative biologists interested in wildlife monitoring

Distance sampling is a useful and widely used method for estimating the density and the abundance of mobile organisms via their distances from a chosen line or point. Since the publication in 1993 of “Distance Sampling: Estimating Abundance of Biological Populations” by Buckland, Anderson, Burnham and Laake [Short Book Reviews, Vol.14, p. 46], much practical and theoretical research has taken place. This new book together with “Advanced Distance Sampling”, in preparation by the same six authors, replaces the earlier volume.

The structure of the book is basically unaltered and the same clear style of writing, tables, and diagrams is maintained. Chapter 1 is greatly revised. In Chapters 3 and 6 some of the more mathematical material, for example on hazard-rate modelling, has been moved to the planned advanced volume. A new section on the efficient generation of distance data is added to Chapter 3. Chapters 4,5 and 7 are intended primarily for biologists; here and elsewhere, useful exercise sections are added for the benefit of graduate students. Chapter 7 is rewritten in order to include new research on the practicalities of survey design and protocol.

The bibliography has doubled in size. It now contains some 600 items relating to references in the text and in the wider literature, making it a valuable resource.

This book is the definitive work on distance sampling. Together with the projected advanced monograph by the same authors, it will provide essential study material for all involved in the estimation of animal abundance.

University of St Andrews
St. Andrews, U.K.

A.W. Kemp


Contents:
1. The making of a gambler
2. What is jai alai?
3. Monte Carlo on the tundra
4. The impact of the Internet
5. Is this bum any good?
6. Modelling the payoffs
7. Engineering the system
8. Putting my money where my mouth is
9. How should you bet?
10. Projects to ponder

Readership: Gamblers, teachers of mathematics, statisticians, the ‘general reader’

This book is published within the OUTLOOKS series – a collaboration between the Mathematical Association of America and Cambridge University Press. The series’ aims are to explore the interplay between mathematics and other disciplines. The idea is to provide ‘a provocative and novel view for mathematicians, and for others an advertisement for the mathematical outlook’.

If you are interested in mathematics and in gambling, then this is certainly one for you! This is a book about trying to predict the future and is in the best tradition of Edward Thorp’s ‘Beat the Dealer’ and for blackjack Thomas Bass’s ‘The Eudaemonic Pie’ for roulette.

The main thrust here is in professional gambling, not only on the outcomes of individual sports contests, but also on the multitude of opportunities within those contests to bet on the individual performances of players. The key is to examine how past performance and current form can be used to gain a profitable edge.

The author’s obsession is with the Basque Sport of jai alai and the mathematical analysis of gambling for this is very well presented here. However, there is also a lot about other sports, for example baseball and, of course, in the general applications of these ideas in predictions of outcomes of elections, performance of financial instruments and of stocks and shares. This is all done at a level accessible to the general reader.

With the generally increasing de-regulation of the gambling industry and its imminent proliferation on the Internet, it is evident that there is a widening market for an anecdotal mathematical book like this. Certainly to begin with a large one. However, winning systems – potential and/or actual – exert an enduring fascination.

Imperial College of Science, Technology and Medicine
London, U.K.
F.H. Berkshire

STATISTICAL THINKING FOR MANAGERS, J.A. John,

Contents:
1. Variation
2. Problem solving
3. Looking at data
4. Modelling data
5. Attribute data
6. Sampling
7. Estimation
8. Regression analysis
9. Multiple regression
10. Forecasting
11. Statistical process control
12. Control charts
13. Improvement strategies
14. Postscript

APPENDIX: Introduction to Excel and Statistical Tables

Readership: Managers and business studies students

The book is designed as an introductory text in business statistics. It is a realistic book that challenges the way the students look at business problems and issues. The importance of statistics is paramount and the text equips the reader with the skills and techniques required to make informed decisions. The authors demonstrate the techniques with a wealth of practical examples drawn from a variety of real life applications. Each chapter is littered with questions for the student to complete. More detailed exercises are at the end of each chapter. One of the innovative features of this book is the inclusion of a number of ‘hands on’ exercises and experiments. No solutions as such are given but supplementary information can be found on the book’s website at http://www.crcpress.com. The book is extremely interesting and would be useful to aid managers in their decision-making process.

South Bank University
London, U.K.
S. Starkings


Contents:
1. Observational studies
2. Randomized experiments
3. Overt bias in observational studies
4. Sensitivity to hidden bias
5. Modes for treatment effects
6. Known effects
7. Multiple reference groups in case-reference studies
8. Multiple control groups
9. Coherence and focused hypotheses
10. Constructing matched sets and strata
11. Planning an observational study
12. Some strategic issues

Readership: Statisticians

This second edition of a book first published in 1995 is about fifty per cent larger than the original [Short Book Reviews, Vol. 16, p.1]. The flavour is the same. The book provides a thoughtful discussion, at a mathematical and conceptual level, of what can and cannot be learned from observational studies. Emphasis is placed on the role of matching, propensity scores, permutation methodology and various types of sensitivity analysis. The book uses many real and interesting examples, but is emphatically not a “how-to” manual or a compendium of techniques – the term logistic regression does not appear in the index and censoring is introduced in the context of a discussion of partial order relationships. There is no discussion of software. Some facility with abstract algebra is needed to follow the detailed arguments. The book will be suitable for a seminar course for talented students with previous knowledge of the subject area.

University of Rochester
Rochester, U.S.A.
D. Oakes

GRAPHICAL MODELS: METHODS FOR DATA ANALYSIS

Contents:
1. Introduction
2. Imprecision and uncertainty
3. Decomposition
4. Graphical representation
5. Computing projections
6. Naïve classifiers
7. Learning global structure
8. Learning local structure
9. Inductive causation
10. Applications
The main theme of this book is the interface of deterministic chaos and statistics in both the mathematics world and real data analysis. This book was written with the intention of taking readers to the forefront of current research on statistical aspects of chaos. Among statisticians there has lately been a growing interest in stochastic dynamical system models for time series whose irregular

APPENDIX A: A Review of Basic Probability Theory
APPENDIX B: Additional Topics in Probability and Analysis
APPENDIX C: Tables

Readership: Beginning graduate students in statistics and science and engineering graduate students whose research will involve statistics intrinsically rather than as an aid in drawing conclusions

Almost twenty-five years have passed since the appearance of the first edition of this classic. Scores of students have studied statistics using it. Many of us no doubt still cherish “the blue book”. As the authors rightly claim, statistical theory has undergone some major changes over this period. This is to a large extent due to increased data availability and computational power. As a consequence, an update of the first edition resulted in almost doubling the size. Volume II is promised for 2003. As can be seen from the table of contents, the present Volume I presents the basics every beginning graduate student in statistics has to master. Volume II will bring students up to speed with respect to current research, including such topics as resampling and MCMC. The authors have managed to keep the splendid balance between methodology and applications; all methods introduced are carried through to the point where the student should be able to apply the techniques to real data. Numerous exercises are included; as in the first edition, these exercises form the backbone for any serious study. Needless to say we are confronted with a really new book, one which every serious statistician (research or graduate student alike) is strongly advised to buy.

ETH-Zürich
Zürich, Switzerland
P.A.L. Embrechts

CHAOS: STATISTICAL PERSPECTIVE.

Contents:
1. Introduction and case studies
2. Deterministic chaos
3. Chaos and stochastic systems
4. Statistical analysis I
5. Statistical analysis II
6. Nonlinear least-square prediction
7. Miscellaneous topics

APPENDIX A: Deterministic chaos
APPENDIX B: Supplements to Chapter 3
APPENDIX C: Data sets and software

Readership: Statisticians, statistically inclined scientists

The main theme of this book is the interface of deterministic chaos and statistics in both the mathematics world and real data analysis. This book was written with the intention of taking readers to the forefront of current research on statistical aspects of chaos. Among statisticians there has lately been a growing interest in stochastic dynamical system models for time series whose irregular
behaviours had traditionally been modelled by random processes. Chapter 2 and 3 provide a reasonably self-contained and informal account of deterministic chaos and the relevant dynamical system theory. Chapters 4 through 6 emphasize statistical analysis of chaos, its initial-value sensitivity and other characteristic properties. Numerous examples and several case studies illustrate the practical scope of the presented techniques and methods. The authors have done an excellent job, providing an overview of known results with detailed references to the literature, as well as pointing out some open problems. In general, the book serves to "encourage more statisticians to join in with the fun of chaos".

University of Wisconsin
Madison, U.S.A.

H. Zhang

STATISTICAL METHODS FOR THE ANALYSIS OF REPEATED MEASUREMENTS.

Contents:
1. Introduction
2. Univariate methods
3. Normal theory methods: Unstructured multivariate approach
4. Normal theory methods: Multivariate analysis of variance
5. Normal theory methods: Repeated measures ANOVA
6. Normal theory methods: Linear mixed models
7. Weighted least squares analysis of repeated categorical outcomes
8. Randomization model methods for one-sample repeated measurements
9. Methods based on extensions of generalized linear models
10. Nonparametric methods

Readership: Statisticians, graduate students in statistics, research scientists

In Chapter 1, the author lists twenty-four books focussing on methodology for repeated measures, all but five written since 1990. So what distinguishes this one from the rest? The claims in the preface are that it is more comprehensive than many, is targeted at a lower mathematical level, is focussed more on applications, is enriched by extensive use of real sets of data, and contains numerous homework exercises.

Even a cursory reading shows these claims to be largely justified, although the less mathematical reader may find parts of some chapters (for example Chapters 4, 7 and 9) rather heavy going. However, each major topic is introduced logically; background theory is clearly elucidated, and at least one example is carefully worked in detail. The use of eighty real sets of data, given in full, is a most attractive feature. Attention is concentrated on those techniques that are most readily available in software. Descriptions are generally clear, and few misprints were noted. This should prove to be a very useful text for teacher, student and practitioner alike.

University of Exeter
Exeter, U.K.

W.J. Krzanowski


Contents:
1. Scope of the monograph
2. Optimal regression designs in symmetric domains
3. Optimal regression designs in asymmetric domains
4. Optimal designs for covariates’ models with structured intercept parameter
5. Stochastic distance optimality
6. Designs in the presence of trends
7. Additional selected topics

Readership: Statisticians, graduate students interested in optimal design

This monograph presents a short overview of the classical theory of optimal regression designs and covers recent developments in certain areas of the authors’ research, mostly within the continuous design paradigm. The authors extensively use Loewner order domination and de la Garza phenomenon. The application of those two concepts is first illustrated for polynomial regression in symmetric design regions, and then generalized to polynomial models in asymmetric regions and regression with non-homogeneous variance. Among other topics are designs for random coefficient regression models, models with trend effects and new developments for distance optimality criterion.

GlaxoSmithKline
Collegeville, U.S.A.

S. Leonov


Contents:
1. Statistical models
2. Data structures
3. Linear algebra tools
4. The classical linear model: Least squares and alternatives
5. Nonlinear models
6. Generalized linear models
7. Linear mixed models for clustered data
8. Nonlinear models for clustered data
9. Statistical models for spatial data

Readership: Model-fitters, especially in the plant and soil sciences

Schabenberger is a mathematical statistician; Pierce directs an agricultural centre. Together they have compiled a magnificent compendium of methods for fitting models with emphasis in one applied area. The writing is first class and the techniques have many wider applications, also. So far, so good. In the preface one reads "This text is an attempt to squeeze between two covers many statistical methods… Any one of …chapters (4 to 9) could have been expanded to the size of the entire text…" True; and so the book is an excellent reference. Further on, one reads "This text is both a reference and textbook…" and the suggestion that the book can be used as a text in both statistics and life sciences courses. True; however, "We did not include exercises…" The stated reason for this is that doing so would limit the range of courses that the book could be used for! Does having no exercises at all paradoxically make the book more versatile then? For calculations, the authors rely on SAS supplemented by the S+SpatialStats module, using the CD-Rom in the book.

University of Wisconsin
Madison, U.S.A.

N.R. Draper
Chapter 3 and 4. Given a proximity measure between objects, Chapter 3 discusses the choices of heterogeneity measures and optimization criteria when partitioning the objects. Chapter 4 discusses merit measures for optimally sequencing objects along a continuum. There is no mention of any practical examples of partitioning and sequencing objects. The authors propose computing the optimal solution to these problems by dynamic programming and illustrate the algorithm with the linear assignment problem. To suggest that the assignment problem be solved by an algorithm that ignores its mathematical structure is irresponsible. There are excellent algorithms for the assignment problem that will solve large problems very quickly. The authors should have demonstrated the dynamic programming algorithm on a small clustering problem.

London School of Economics
London, U.K. S. Powell

MULTIVARIATE STATISTICAL PROCESS CONTROL WITH INDUSTRIAL APPLICATIONS

Contents:
1. Introduction to the $T^2$ statistic
2. Basic concepts about the $T^2$ statistic
3. Checking assumptions for using a $T^2$ statistic
4. Construction of historical data set
5. Charting the $T^2$ in phase I
6. Charting the $T^2$ in phase II
7. Interpretation of $T^2$ signals for two variables
8. Interpretation of $T^2$ signals for the general case
9. Improving the sensitivity of the $T^2$ statistic
10. Autocorrelation in $T^2$ control charts
11. The $T^2$ statistic and batch processes

Readership: Senior students and practitioners with a statistical background in process industries

The book is aimed at senior students and practitioners with a statistical background in process industries. The authors provide a step-by-step approach to developing and applying a control chart based on Hotelling’s $T^2$ statistic to processes with a large number of variable characteristics measured over time. There are many examples with excellent context woven into the theory. A running example, written as a short story, is used to demonstrate the value of the approach. An accompanying CD provides a ninety-day demonstration version of the software used in the text’s examples.

There is little comparison to other monitoring methods such as those based on principal components or PLS. I expect that many students with no experience of process industries will find the examples difficult and that practitioners, unfamiliar with multivariate analysis, will struggle with the theory. The data for the examples are not available on the CD. There are no exercises.

University of Waterloo
Waterloo, Canada R.J. MacKay


Contents:
1. Introduction
2. General aspects of fitting regression models
3. Missing data
4. Multivariable modelling strategies
5. Re-sampling, validating, describing, and simplifying the model
6. S-plus software
7. Case study in least squares fitting and interpretations of a linear model
8. Case study in imputation and data reduction
9. Overview of maximum likelihood estimation
10. Binary logistic regression
11. Logistic model case study 1: Predicting cause of death
12. Logistic model case study 2: Survival of Titanic passengers

University of Waterloo
Waterloo, Canada R.J. MacKay


Contents:
1. Introduction
2. General dynamic programming paradigm
3. Cluster analysis
4. Object sequencing and seriation
5. Heuristic application of the GDP
6. Extensions and generalizations

Readership: Combinatorialists

The core of this highly specialized text is given in Chapters 3 and 4. Given a proximity measure between $n$ objects, Chapter 3 discusses the choices of heterogeneity measures and optimization criteria when partitioning the objects. Chapter 4 discusses merit measures for optimally sequencing objects along a continuum. There is no mention of any practical examples of partitioning and sequencing objects. The authors propose computing the optimal solution to these problems by dynamic programming and illustrate the algorithm with the linear assignment problem. To suggest that the assignment problem be solved by an algorithm that ignores its mathematical structure is irresponsible. There are excellent algorithms for the assignment problem that will solve large problems very quickly. The authors should have demonstrated the dynamic programming algorithm on a small clustering problem.

 Imperial College of Science, Technology and Medicine
London, U.K. D.J. Hand


Contents:
1. Introduction
2. Models
3. Effects and hypotheses
4. Estimators for relative effects
5. Test statistics
6. Software
7. Experiments for one group of subjects
8. Experiments for several groups of subjects
9. Dependent replications
10. Multifactorial experiments
11. Numerous time points

Readership: Statisticians or statistically literate applications experts with repeated measures problems

Longitudinal data have been the focus of a striking efflorescence of research activity over the last couple of decades. So much so, in fact that, the researcher concerned with applications may not have the time to understand them all and choose that one which is best suited to the problem. Moreover, there may also be doubts about the appropriateness of the models in the context of the data. This book describes attempts to ease these issues by adopting nonparametric procedures, in particular in the context of factorial designs.

The book includes real examples from a wide range of application domains. It would be interesting to see comparative analyses of these examples, using standard approaches. Macros for the various analyses are described, and an internet address is given from which they may be downloaded. There are exercises at the end of each chapter, though most of these appear to be of the ‘apply the methods described here to the data described here’ form.

Perhaps it is in the nature of nonparametric methods, but my overall impression was of a field still under development. Indeed, the authors’ comments in Chapter 6 on the software available (or rather, not available) for such methods in major packages supports this.

University of Waterloo
Waterloo, Canada R.J. MacKay
13. Ordinal logistic regression
14. Case study in ordinal regression, data reduction, and penalization
15. Models using nonparametric transformations of $X$ and $Y$
16. Introduction to survival analysis
17. Parametric survival models
18. Case study in parametric survival modelling and model approximation
19. Cox proportional hazards regression model
20. Case study in Cox regression

Readership: Model-builders of many kinds

This is a book that leaves one breathless. It demands a lot, but gives plenty in return. Prospective readers need a statistics course and should be “well versed in ordinary multiple regression and intermediate algebra”. They also need to be thoroughly familiar with S-PLUS or R; instructions for learning about these and about a library of special S-PLUS functions are given in the preface and appendix. The book has many sets of programming instructions and printouts, all delivered in a staccato fashion. Sets of data are large (for example, random sample of 10% of 10,000 hospitalized adults, page 51; 1309 Titanic survivors, page 300). Many different types of models and methods are discussed. There are many printouts and diagrams. Computer oriented readers will like this book immediately. Others may grow to like it. It is an essential reference for the library.

University of Wisconsin
Madison, U.S.A. N.R. Draper

A CONTINGENCY TABLE APPROACH TO NONPARAMETRIC TESTING

Contents:
1. Introduction
2. Modelling ties
3. Tests on one-way layout data: Extensions to the median and Kruskal-Wallis tests
4. Tests based on a product multinomial model: Yates’ test and its extensions
5. Further tests based on a product multinomial model: Order in the sign test and ordinal categorical data with a factorial response
6. Tests on complete randomized blocks: Extensions to the Friedman and Cochran tests
7. Further tests on randomized blocks: Extensions to Durbin’s test
8. Extensions to a nonparametric correlation test: Spearman’s test
9. One and S-sample smooth tests of goodness of fit
10. Conclusion

Readership: Experimental scientists, statisticians

This book shows how many standard nonparametric tests, such as Wilcoxon, Kruskal-Wallis and Spearman can be obtained from appropriate partitions of a Pearson $X^2$ test statistic. This unification is accomplished by presenting the data in contingency tables. The approach is given in Sprent (1993, Section 9.3), for instance, but it is generalized here. The treatment of ties, and the construction of almost exact Monte Carlo $p$-values are both readily dealt with. The book is up-to-date, and in many cases draws on the research of the authors and their co-workers, as in, for example, Chapters 8 and 9. The book considers historical sets of data, but the work is also very nicely illustrated by many examples from the area of sensory evaluation, drawn from the extensive consulting experience of Best. Various new results are also presented, as in Section 4.6, where the McCullagh (1980) method for ordered contingency tables is found to be outperformed by alternatives. Overall, material is presented without excessive theory. This is a useful and informative text, which deserves to be widely read.


University of Kent
Canterbury, U.K.

SMOOTHING SPLINE ANOVA MODELS, C. Gu.
New York: Springer-Verlag, 2002, pp. xii + 289, US$79.95

Contents:
1. Introduction
2. Model construction
3. Regression with Gaussian-type responses
4. More splines
5. Regression with exponential families
6. Probability density estimation
7. Hazard rate estimation
8. Asymptotic convergence

Readership: Graduate students with a solid background in mathematics and research statisticians

This is the only book available now written exclusively on the method of smoothing spline ANOVA, a newly-developed and broadly-applicable approach to nonparametric functional estimation problems. The author is one of the few main contributors to the development of this field. This book is mainly a summary of the author and his co-researchers’ own work. Three main topics discussed are regression (in a generalized sense), density estimation and hazard rate estimation. Understandably, the focus is on fitting functions and not on inferences and predictions. The exposition style is for the most part heavily mathematical. There are a few illustrative examples and some discussion on using a R package developed by the author to do part of the computation in the book.

Pennsylvania State University
University Park, U.S.A.

ANALYZING MEDICAL DATA USING S-PLUS,

Contents:
Prologue
1. An introduction to S-PLUS
2. Describing data
3. Basic inference
4. Scatterplots, simple regression and smoothing
5. Analysis of variance and covariance
6. The analysis of longitudinal data
7. More graphics
8. Multiple linear regression
9. Generalized linear models I: Logistic regression
10. Generalized linear models II: Poisson regression
11. Linear mixed models I
12. Linear mixed models II
13. Generalized additive models
14. Nonlinear models
15. Regression trees
16. Survival analysis I
17. Survival analysis II: Cox’s regression
18. Principal components and factor analysis
19. Cluster analysis
20. Discriminant function analysis

Readership: Medical researchers who analyze statistical data, medical statisticians, students of statistics and medical statistics

This book presents a survey of modern methods used in, but not confined to, medical statistics, each accompanied by a brief summary of the mathematical components, instruction in the basics of the S-PLUS computer language, up-to-date references, examples using sets of data from medical research, and S-PLUS code for the examples. The sets of data and S-PLUS code are available for downloading from a website referenced in the book (some but not all of the S-PLUS code runs in R, the freeware counterpart of S). Given the number of methods covered, it is not surprising that discussion of interpreting output, limitations of methods and comparison of alternative analyses is largely absent; effective use, therefore, requires some statistical background. The book will be a handy reference on my consulting shelf.

Queen’s University
Kingston, Canada

J.T. Smith

NONLINEAR MODELS IN MEDICAL STATISTICS

Contents:
1. Basic concepts
2. Practical aspects
3. Families of nonlinear regression functions
4. Epidemiology
5. Clinical trials
6. Quality of life
7. Pharmacokinetics
8. Pharmacodynamics
9. Assays and formulations
10. Molecular genetics

Readership: Graduate students in biometry, bio-statistics, medicine and statistics

This book provides a practical text on nonlinear modelling with the emphasis on applications in medicine. In contrast to most publications on the subject, the emphasis is on models involving non-normal response distributions. Knowledge of advanced mathematics and statistics is assumed but a comprehensive list of reference texts is cited in the bibliography. Examples in the text are analyzed using computer code written in the freely available software R. The larger sets of data presented and analyzed in the examples are not reproduced in the text but are available through the World Wide Web. At the end of each chapter there is a further reading list together with a limited number of exercises; these might be incorporated into a short taught course on the subject. Tables of data for the exercises are provided in one of the three appendices. The text is well-written and the mix of applications should appeal to a wide readership.

CEFAS Lowestoft Laboratory
Lowestoft, U.K.

C.M. O’Brien

ACCELERATED LIFE MODELS: MODELLING AND STATISTICAL ANALYSIS.

Contents:
1. Failure time distributions
2. Accelerated life models
3. Accelerated degradation models
4. Maximum likelihood estimation for FTR data
5. Parametric AFT model
6. Semiparametric AFT model
7. The Cox of PH model
8. GPH models: FTR analysis
9. Changing scale and shape model
10. GAH and GAMH models
11. Estimation when a process of production is unstable
12. Goodness-of-fit for accelerated life models
13. Estimation in degradation models

APPENDIX A: Some Results from Stochastic Process Theory

Readership: Academic researchers, postgraduate students

The book gives a full and detailed survey of models and their properties and implications. In addition to failure times, degradation processes are also covered. Comparisons are made between accelerated-life and proportional-hazards models, and some semi-parametric models are also discussed.

The style is theoretical, with a high equation-count, at a level suitable for academic researchers and postgraduate students. The material reflects a substantial contribution to the literature in this area by the authors over the past twenty years.

There are no worked-data examples or any discussion of numerical and computational issues in fitting models. The brand of inference is frequentist, centred on maximum likelihood estimators and their asymptotic properties derived by martingale counting-process methods.

Imperial College of Science, Technology and Medicine
London, U.K.

M.J. Crowder


Contents:
1. Introduction
2. Empirical likelihood
3. EL for random vectors
4. Regression and modeling
5. Empirical likelihood and smoothing
6. Biased and incomplete samples
7. Bands for distributions
8. Dependent data
9. Hybrids and connections
10. Challenges for EL
11. Some proofs
12. Algorithms
13. Higher order asymptotics

Readership: Statisticians, graduate students in statistics, practitioners with a reasonable degree of statistical sophistication

Empirical likelihood is a nonparametric technique that captures many of the advantages of conventional parametric likelihood methods without the disadvantage of their distributional assumptions. The basic idea is to use a likelihood based on a multinomial distribution with support on the observed sample points. Although there were precursors in sample survey theory and survival analysis, for example, the basic approach was developed by the author himself in a series of fundamental papers in the late 1980s and early 1990s. Since then many other people have extended the ideas and theory. This is the first book devoted to the topic and gives an excellent overview of the diversity of applications that can be treated and the potential of the empirical likelihood approach in applied statistics.

The emphasis is on applications and data analysis rather than theory, with most of the technical material collected in the final chapters, although the early chapters still require a reasonable acquaintance with statistical
theory. The book starts with an example to illustrate the power of the empirical likelihood approach in a situation that would be difficult to handle with conventional methods. It then moves on to the core material in Chapters 2, 3 and 4, which cover inferences for means (both univariate and multivariate), estimating equations, regression, analysis of variance and generalized linear models. As the author says in the preface, these four chapters, along with some supplementary material from later chapters, could form the basis of a good graduate course. A variety of more specialized topics are treated in Chapters 5 to 8. Connections with other methods, especially the bootstrap, are discussed in Chapter 9 and Chapter 10 contains a sketch of some situations that pose difficulties for the empirical likelihood approach and of areas for future development. Proofs, higher-order asymptotic properties and some computational questions are discussed in the final three chapters.

Empirical likelihood is a powerful, but less familiar, alternative to bootstrapping in many situations. Unlike the bootstrap, there are few good general descriptions of empirical likelihood in existence and no widely available software that would enable practitioners to implement the method easily. This timely and well-written book remedies the first of these problems and, it is hoped that it will soon help to lead to more accessible software being produced.

University of Auckland
Auckland, New Zealand

A.J. Scott

PERMUTATION METHODS: A DISTANCE FUNCTION APPROACH

P.W. Mielke, Jr. and K.J. Berry.
New York: Springer-Verlag, 2001, pp. xv + 352,
US$79.95/DM160.00.

Contents:
1. Introduction
2. Description of MRPP
3. Further MRPP applications
4. Description of MRBP
5. Regression analysis, prediction, and agreement
6. Goodness-of-fit tests
7. Contingency tables
8. Multisample homogeneity tests

Readership: Final year undergraduate and post-graduate students in statistics

This timely and well-written book remedies the first of these problems and, it is hoped that it will soon help to lead to more accessible software being produced.

University of Auckland
Auckland, New Zealand

A.J. Scott

A GUIDE TO FIRST-PASSAGE PROCESSES, S. Render.
Cambridge University Press, 2001, pp. ix + 312,
£55.00/US$80.00.

Contents:
1. First-passage fundamentals
2. First-passage in an interval
3. Semi-infinite system
4. Illustrations of first-passage in simple geometries
5. Fractal and nonfractal networks
6. Systems with spherical symmetry
7. Wedge domains
8. Applications to simple reactions

Readership: Graduate students and researchers in physics, chemistry, theoretical biology, electrical engineering, chemical engineering, operations research and finance

ETH-Zürich
Zürich, Switzerland

L. Alli

A USER’S GUIDE TO MEASURE THEORETIC PROBABILITY, D. Pollard.
Cambridge University Press, pp. xxiii + 351,
£60.00/US$90.00 Cloth; £20.90/US$30.00 Paper.

Contents:
1. Motivation
2. A modicum of measure theory
3. Densities and derivatives
4. Product spaces and independence
5. Conditioning
6. Martingale et al.
7. Convergence in distribution
8. Fourier transforms
9. Brownian motion
10. Representations and couplings
11. Exponential tails and the law of the iterated logarithm
12. Multivariate normal distributions

Readership: Probabilists, mathematicians, statisticians, teachers, students

This is a most remarkable book in that it succeeds in explaining the toughest probabilistic concepts without burying the reader under a pile of unwanted measure theory. Even a quick look at the titles of the sections shows that all important concepts from current day probability are there. But there is more: ideas and techniques from functional analysis are sprinkled over the manuscript, hundreds of exercises of varying degrees in difficulty andre are included, and each chapter ends with miscellaneous notes that guide the reader to other aspects not covered in the book but hinted at in the extensive bibliography. A refreshing book that can be strongly recommended to
students as well as to teachers that like to learn rigorous probability theory without being forced to become professional probabilists first.

Katholieke Universiteit Leuven
Heverlee, Belgium
J.L. Teugels


Contents:
PART I: Introduction
1. Random vectors
2. Linear operators
3. Infinitely divisible distributions and triangular arrays
PART II: Multivariate Regular Variation
4. Regular variation for linear operators
5. Regular variation for real-valued functions
6. Regular variation for Borel measures
PART III: Multivariate Limit Theorems
7. The limit distributions
8. Central limit theorems
9. Related limit theorems
PART IV: Applications
10. Applications to statistics
11. Self-similar stochastic processes

Readership: Researchers in probability and statistics

Central limit theory is fundamental to many results and methods in statistics and applied probability. This includes the classical central limit theorem with normal limit distributions but also, because of the rapidly increasing interest in the modelling of heavy-tailed phenomena, limit theory for convergence of appropriately normalized sums of independent random vectors to non-normal limits. This book treats the general central limit theory in detail through extensive use of the concept of multivariate regular variation, in particular regular variation for linear operators. The presentation is self-contained in the sense that all tools required for developing the theory, such as convergence of measures, infinite divisibility and multivariate regular variation, are presented in detail. I would like to stress that the approach to multivariate regular variation presented no doubt is useful for the limit theorems treated, but may be less convenient for important applications to other fields like extreme value theory. Researchers in probability and statistics will find it a carefully written and accessible reference for limit results for sums of independent random vectors, a topic of considerable importance in a wide variety of applied problems as seen from the applications addressed in the last chapters of the book.

ETH-Zürich
Zürich, Switzerland
F. Lindskog


Contents:
1. Foundations
2. Random sums
3. Large deviation principles
4. Excursion random measures
5. Exceedance and first passage lines
6. Extremal properties of some statistics
7. GARCH processes
8. Sequential analysis
9. Change-point problems

Readership: Theoretical researchers in statistics

This is volume XII in a series of books on weakly dependent stochastic sequences, all written by the same author over the past ten years. Like all the previous ones in the collection, this volume is also written in a very mathematical style, using the strict format of definition – conditions – lemmas – theorems – proofs. The theorems rely on the most recent journal literature in the field. As seen from the table of contents, the author deals with miscellaneous topics. Most interesting is the extreme value theory for stationary sequences under suitable mixing conditions, the extremal behaviour of autoregressive processes and the asymptotics for change-point estimators under weak dependence. The book is useful for theoretical researchers in these topics.

Limburgs Universitair Centrum
Diepenbeek, Belgium
N.D.C. Veraverbeke


Contents:
1. Simulation in perspective
2. Modelling concepts
3. Data collection and averages
4. Programming and execution
5. Search, space, and time
6. Output analysis
7. Making sense of output and increasing efficiency
8. Sampling from probability distributions
9. Pseudo-random number generation
10. Preparing the input

Readership: Researchers, graduates students, and advanced undergraduate students with an interest in the simulation of stochastic systems

This is an excellent and well-written text on discrete event simulation with a focus on applications in Operations Research. There is substantial attention to programming (largely in SIMSCRIPT II.5), output analysis, pseudo-random number generation and modelling and these sections are quite thorough. Methods are provided for generating pseudo-random numbers (including combining such streams) and for generating random numbers from most standard statistical distributions. I might quibble with the author on choice of topics. For example, there is less (or no) attention paid to variance-reduction techniques, validation and verification of models, regenerative simulation, sensitivity analysis or Infinitesimal Perturbation Analysis. The author has clearly sacrificed some potential coverage for a text that is accessible, coherent and readable on those topics of major interest to “simulationists” in the management and engineering sciences.

University of Waterloo
Waterloo, Canada
D.L. McLeish


Contents:
THE LAPLACE DISTRIBUTION AND GENERALIZATIONS

Contents:
PART I: Univariate Distributions
1. Historical background
2. Classical symmetric Laplace distribution
3. Asymmetric Laplace distributions
4. Related distributions
PART II: Multivariate Distributions
5. Symmetric multivariate Laplace distribution
6. Asymmetric multivariate Laplace distribution
PART III: Applications
7. Engineering sciences
8. Financial data
9. Inventory management and quality control
10. Astronomy and the biological and environmental sciences
APPENDIX: Bessel Functions

Readership: Researchers in communication, economics, engineering, and finance

After a brief introduction on the history of the Laplace distribution in which a comparison with the normal distribution is made, the authors give a detailed study of the one-dimensional theory. Several analytic properties are presented including transforms, sums, mixtures, infinite divisibility and characterizations. Several of these properties are extended to the multivariate case. A brief discussion of the Laplace process, as a special case the Lévy process, is given. The examples given show for what kind of problems these models can be used. Throughout the text, several historical remarks and exercises are given. This book will be useful for those who are interested in tractable models which allow one to go beyond the normal distribution.

ETH-Zürich
Zürich, Switzerland
P.A.L. Embrechts


Contents:
1. Historical background
2. Probability theory
3. Stochastic processes
4. Einstein-Smoluchowski theory
5. Stochastic differential equations and integrals
6. Functional integrals
7. Some important special cases
8. The Smoluchowski equation
9. Random walk
10. Statistical mechanics
11. Stochastic equations from a statistical mechanical viewpoint
12. Two exactly treatable models
13. Brownian motion and noise
14. Diffusion phenomena
15. Rotational diffusion
16. Polymer solutions
17. Interacting Brownian particles
18. Dynamics, fractals and chaos

Readership: Physicists and mathematicians interested in the physics background of Brownian motion

Having borrowed its name from the biologist Robert Brown (1773-1858), Brownian motion found its way into mainstream physics through the work of Einstein and Smoluchowski. Perrin (1909) gave experimental verification of the ES theory and J.J. Thompson’s work on the electron finally sealed the atomic theory of matter, and hence Brownian motion as a fundamental process underlying microscopic movement. After a brief discussion of this historical basis, the author then explains how Brownian motion technology was further developed within physics. The emphasis is very much put on physical relevance rather than mathematical depth. All constants appearing have a physical meaning. The historical development of the subject appears consequently throughout the text. Though the author is aware of the huge mathematical literature, he stays firmly within the realm of physics; recent probabilistic standard texts like Karatzas-Shreve or Revuz-Yor are not referred to. I do however find that this book makes a nice and even refreshing complement to the overwhelming emphasis put on the application of Brownian motion to finance in most of the books on the subject written for mathematicians. No doubt physicists will find the text useful. I am also convinced that mathematicians with a keen interest in the subject will want to go back to its historical roots and learn how Brownian motion has fared within fields of applications motivated by physics.

ETH-Zürich
Zürich, Switzerland
P.A.L. Embrechts

PROBABILITY AND FINANCE: IT’S ONLY A GAME.

Contents:
1. Probability and finance as a game
PART I: Probability Without Measure

Readership: Researchers in communication, economics, engineering, and finance
2. The historical context
3. The bounded strong law of large numbers
4. Kolmogorov’s strong law of large numbers
5. The law of the iterated logarithm
6. The weak laws
7. Lindeberg’s theorem
8. The generality of probability games

PART II: Finance Without Probability
9. Game-theoretic probability in finance
10. Games for pricing options in discrete time
11. Games for pricing options in continuous time
12. The generality of game-theoretic pricing
13. Games for American options
14. Games for diffusion processes
15. The game-theoretic efficient-market hypothesis

Readership: Mathematicians, statisticians and philosophers interested in the foundations of probability, and anyone interested in a new approach to pricing derivatives

The first half of this book develops probability theory from a novel game-theoretic perspective, rather than the standard measure-theoretic perspective. However, the authors take pains to point out that this theoretical development has not yet been completed, with rich possibilities for further work existing. Relationships between the game-theoretic perspective and other approaches to probability are described, with the developments of the various interpretations of probability and alternative foundations being set in a historical context. The second half applies these new ideas to pricing financial derivatives.

This is a creative, entertaining and imaginative book. It will make intriguing reading for any statistician who wants something a little out of the ordinary, and for anyone who is attracted by the challenge of the authors’ assertion that the game-theoretic approach ‘goes deeper into probability’s conceptual roots than the established measure-theoretic framework, [it] is better adapted to many practical problems, and [it] clarifies the close, relationship between probability theory and finance theory’.

Imperial College of Science, Technology and Medicine
London, U.K.

D.J. Hand


Contents:
1. Univariate stochastic orders
2. Theory of integral stochastic orders
3. Multivariate stochastic orders
4. Stochastic models, comparison and monotonicity
5. Monotonicity and comparability of stochastic processes
6. Monotonicity properties and bounds for queueing systems
7. Applications to various stochastic models
8. Comparing risks

Readership: Academic researchers in mathematics, probability, statistics, physics, economics

The book gives a fairly formal exposition of the theory, much of it in the style of Theorem-Proof-Remarks. However, there is also a wealth of discussion and some important applications are thoroughly explored. The material is presented at the research level: references to the literature abound and, for example, there are no collections of student exercises.

In Chapter 1 there are many kinds of criteria for, and developments of the basic idea that one random variable can tend to take larger values than another. Chapter 2 is focussed upon a particular class, called integral stochastic orderings. In Chapter 3 the treatment is extended to multivariate distributions, and in Chapter 4 methods are presented for relating ordering properties of systems to those of their components. The theory is applied to stochastic processes. Markov processes in particular, in Chapter 5, and to queuing systems in Chapter 6. Chapter 7 contains a variety of applications, including renewal processes, reliability, scheduling, random sets and point processes, and the Ising model. Finally, some financial applications, portfolio optimization and actuarial risk, are covered in Chapter 8.

Imperial College of Science
Technology and Medicine
London, U.K.

M.J. Crowder


Contents:
1. Introduction
2. Analysis of algorithms
3. Basic financial mathematics
4. Bond price volatility
5. Term structure of interest rates
6. Fundamental statistical concepts
7. Option basics
8. Arbitrage in option pricing
9. Option pricing models
10. Sensitivity analysis of options
11. Extensions of options theory
12. Forwards, futures, futures options, swaps
13. Stochastic processes and Brownian motion
14. Continuous-time financial mathematics
15. Continuous-time derivative pricing
16. Hedging
17. Trees
18. Numerical methods
19. Matrix computation
20. Time series analysis
21. Interest rate derivative securities
22. Term structure fitting
23. Introduction to term structure modelling
24. Foundations of term structure modelling
25. Equilibrium term structure models
26. No-arbitrage term structure models
27. Fixed-income securities
28. Introduction to mortgage-backed securities
29. Analysis of mortgage-backed securities
30. Collateralized mortgage obligations
31. Modern portfolio theory

Readership: These in academian and the finance industry

The book is aimed at engineering and science students wishing to pursue quantitative finance, so no finance background is assumed. It will also be useful as a reference for workers in the finance industry. The flavour is inter-disciplinary, drawing together financial mathematics, econometrics and computation. The material is presented in small packets on the whole, for example the average chapter length is 15 pages; for me, this encourages self-study and reference. Many examples and exercises are interspersed throughout the text, and detailed answers to many of the latter given at the end. The computational aspects are Web-centric, to quote the author: the Java-based software can be accessed through a given web site. A guide to additional reading is appended to each chapter, referring to a huge bibliography (897 items), together with some miscellaneous notes. The index is likewise extremely thorough.

Imperial College of Science
Technology and Medicine
both work in a bank) contributes hugely to its format. I also

PART I. Models: Theory and Implementation

Contents:

1. Financial time series and their characteristics
2. Linear time series analysis and its application
3. Conditional heteroscedastic models
4. Nonlinear models and their applications
5. High-frequency data analysis and market microstructure
6. Continuous-time models and their applications
7. Extreme values, quantile estimation, and value at risk
8. Multivariate time series analysis and its applications
9. Multivariate volatility models and their applications
10. Markov chain Monte Carlo methods with applications

Readership: Academia (mathematics, statistics, economics undergraduates, MBA students), finance industry (quantitative analysts, statisticians).

A major strength of the book is that it presents both the theory and the practice for the various methods. Another feature is the coverage of recent advances in the methodology. The technical level is (approximately) first year undergraduate mathematics, together with a working knowledge of statistics. There are exercises and references at the end of each chapter. Programming code is listed for applying the methods, mainly using the RATS package, and real-data examples are tracked. Some chapters have appendices covering essential basic material, for example review of probability distributions, vectors and matrices, and the Black-Scholes formula. This will be a very useful book for learning and reference.

Imperial College of Science, Technology and Medicine
London, U.K.

M.J. Crowder

INTEREST RATE MODELS. Theory and Practice.

Contents:

PART I. Models: Theory and Implementation
1. Definitions and notation
2. No-arbitrage pricing and numeraire change
3. One-factor short-rate models
4. Two-factor short-rate models
5. The Heath-Jarrow-Morton (HJM) framework
6. The LIBOR and swap market models (LFM and LSM)
7. Cases of calibration of the LIBOR market model
8. Monte Carlo tests for LFM analytical approximations
9. Other interest-rate models

PART II. Pricing Derivatives in Practice
10. Pricing derivatives on a single interest-rate curve
11. Pricing derivatives on two interest-rate curves
12. Pricing equity derivatives under stochastic rate

PART III. Appendices
A. Crash Introduction to Stochastic Differential Equations
B. A Useful Calculation
C. Approximating Diffusions with Trees
D. Talking to the Trades

Readership: Those interested in quantitative finance

The text is no doubt my favourite on the subject of interest rate modelling. It perfectly combines mathematical depth, historical perspective and practical relevance. The fact that the authors combine a strong mathematical (finance) background with expert practice knowledge (they both work in a bank) contributes hugely to its format. I also admire the style of writing: at the same time concise and pedagogically fresh. The authors’ applied background allows for numerous comments on why certain models have (or have not) made it in practice. The theory is interwoven with detailed numerical examples. A final Appendix “discussion” with a trader yields insight into current and future development of the field. For those who have a sufficiently strong mathematical background, this book is a must.

ETH-Zürich
Zürich, Switzerland

P.A.L. Embrechts


Contents:

1. Introduction
2. Basics of statistical modeling
3. Classical extreme value theory and models
4. Threshold models
5. Extremes of non-stationary sequences
6. A point characterization of extremes
7. Multivariate extremes
8. Further topics

Readership: Statisticians, risk management professionals, economists, engineers

This book is an accessible introduction to the univariate and multivariate extreme value methods. Topics on classical block maxima models, threshold exceedance models, modeling and testing issues with extremes of dependent sequences, explorations on extremes of nonstationary sequences and an introduction to multivariate extremes are covered. It contains numerous examples and applications with sets of data from various fields including engineering, oceanography and finance. It also contains a list of web sites where software routines for the extreme value methods are available.

University of Windsor
Windsor, Canada

R. Gençay

CREDIT RISK: MODELING, VALUATION AND HEDGING.

Contents:

1. Introduction to credit risk
2. Corporate debt
3. First-passage time models
4. Hazard function of a random time
5. Hazard process of a random time
6. Martingale hazard process
7. Case of several random times
8. Intensity-based valuation of defaultable claims
9. Conditionally independent defaults
10. Dependent defaults
11. Markov chains
12. Markovian models of credit migrations
13. Heath-Jarrow-Morton type models
14. Defaultable market rates
15. Modeling of market rates

Readership: Researchers, graduate students and practitioners with a knowledge of stochastic calculus and arbitrage pricing theory

The intention of this monograph is to provide a comprehensive summary of recent advances in credit risk research including the value-of-the-firm and the intensity-based approaches. The emphasis is on the models,
expressed through stochastic differential equations, leading to assessment of risk. The book is at an advanced mathematical level and covers a great deal of ground, discussing the results in hundreds of papers on the subject. In spite of considerable coverage and a mathematical approach, it is not difficult to read. My only criticism is generalizable to a great deal of finance literature; for all the high-level discussion of competing models, there is often a conspicuous lack of fitting these models to data and comparing their goodness-of-fit. The purpose of this book, to provide access to the explosive new research in credit risk and the accompanying mathematical models, is well-served.

University of Waterloo
Waterloo, Canada

D.L. McLeish

LINEAR PROGRAMMING: Foundations and Extensions.

Contents:
PART I. Basic Theory. The Simplex Method and Duality
  1. Introduction
  2. The simplex method
  3. Degeneracy
  4. Efficiency of the simplex method
  5. Duality theory
  6. The simplex method in matrix notation
  7. Sensitivity and parametric analysis
  8. Implementation issues
  9. Problems in general form
  10. Convex analysis
  11. Game theory
  12. Regression
PART II: Network–Type Problems
  13. Network flow problems
  14. Applications
  15. Structural optimization
PART III: Interior–Point Methods
  16. The central path
  17. A Path-Following method
  18. The KKT system
  19. Implementation issues
  20. The affine–scaling method
  21. The homogeneous self–dual method
PART IV: Extensions
  22. Integer programming
  23. Quadratic programming
  24. Convex programming

Readership: Mathematical programmers, operational researchers

This elegant text is eminently suitable for use in teaching linear programming to third year undergraduates or postgraduates. The carefully written material is presented as a reader friendly blend of mathematics and numerical examples. The author clearly prefers to solve problems by computer, rather than by hand, and his chapters on implementation issues are welcome. All the algorithms in the book have been coded and the source code, in C, is available from the author’s website. An important contribution of this book is the section on Interior Point Methods; the author has research experience in this area and uses his expository skills to describe the algorithms and to discuss the relationship between these methods. This book is highly recommended, it is a must for modern linear programmers.

London School of Economics
London, U.K.

S. Powell


Contents:
1. Linear programming: Basic concepts
2. Dantzig’s simplex method
3. Duality and optimality
4. Sensitivity analysis
5. Karmarkar’s interior path method
6. Integer linear programming
7. Linear network models
8. Computational complexity issues
9. Model building, case studies, and advanced techniques

Readership: Mathematical programmers, operational researchers

This text is one of many suitable for a third year undergraduate or postgraduate course, that describes linear and integer programming theory. It is satisfying that an interior point method is now so well understood that it appears as a chapter alongside chapters on the classical simplex and network flow algorithms. The computer program INTPM enables the user to solve small (less than 75 variables and 40 equality constraints) problems using an interior point method. The author thanks the editorial staff of Marcel Dekker for their professional expertise; regrettably this did not extend to typographic issues. The text is too widely spaced, indeed on many pages it appears as if there are three spaces either side of each word. An English-speaking proof reader would have been helpful.

London School of Economics
London, U.K.

S. Powell

OPTIMIZATION HEURISTICS IN ECONOMETRICS.

Contents:
1. Introduction
PART I: Optimization in Statistics and Econometrics
  2. Optimization in economics
  3. Optimization is statistics and econometrics
  4. The heuristic optimization paradigm
PART II: Heuristic Optimization: Threshold Accepting
  5. Optimization methods
  6. The global optimization heuristic threshold accepting
  7. Relative performance of threshold accepting
  8. Tuning of threshold accepting
  9. A practical guide to the implementation of threshold accepting
PART III: Application in Statistics and Econometrics
  10. Introduction
  11. Experimental design
  12. Identification of multivariate lag structures
  13. Optimal aggregation
  14. Censored quantile regression
  15. Continuous global optimization
PART IV: Conclusion and Outlook
  16. Conclusion
  17. Outlook for further research

Readership: Economists, econometricians, operational researchers

In the last decade the methods of heuristic optimization, for example simulated annealing, tabu search, neural networks and genetic algorithms have been satisfactorily applied by operational researchers to their combinatorial optimization problems. This text aims to demonstrate to economists and econometricians that these methods are accessible, powerful and useful for their models. The author is
keen to convince economists that there are optimization tools, other than the classical methods, that can be applied to difficult or intractable problems. Many of the algorithms have been computationally implemented and the description of this practical experience is invaluable to readers with a problem to solve. There is an ‘art’ in successfully using these methods, and, because of its heuristic nature, it is an area little discussed in the literature. A text that comprehensively addresses this ‘art’ is to be welcomed.

London School of Economics
London, U.K.
S. Powell


From the book jacket: “Is the university a dinosaur: huge, lumbering, endearing in its own way, yet unsuited to today’s world? Is it a thing of the past, unnecessary in an age of the Internet and on-line learning? In a book likely to provoke those who foresee its demise, the author acknowledges that the university is an imperfect institution but argues that it plays an essential role in modern society. In the process, he articulates strong opinions on a range of difficult issues.”


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“Edward Teller is perhaps best known for his belief in freedom through strong defence. But this extraordinary memoir at last reveals the man behind the headlines – passionate and humorous, devoted and loyal. Never before has Teller told his story as fully as he does here. We learn Teller’s true position on everything from the bombing of Japan to the pursuit of weapons research in the post-war years.

“In clear and compelling prose, Teller chronicles the people and events that shaped him as a scientist, beginning with his early love of music and math, and continuing with his study of quantum physics under Werner Heisenberg.

“Present at many of the pivotal moments in modern science, Teller also describes his relationships with some of the century’s greatest minds – Einstein, Bohr, Fermi, Szialard, von Neumann – and offers an honest assessment of the development of the atomic and hydrogen bombs, the founding of Lawrence Livermore Laboratory, and his complicated relationship with J. Robert Oppenheimer. He also offers, for the first time, a moving portrait of his childhood, his marriage and family life, and his deep friendship with physicist Maria Mayer.

“Writing about those aspects of his life that have had important public consequences – from his conservative politics to his relationships with scientists and presidents – Teller reveals himself to be a man with deep beliefs about liberty, security, and the moral responsibility of science.

“Rich and humanizing, this candid memoir describes the events that led Edward Teller to be honored or abhorred, and provides a fascinating perspective on the ability of a single individual to affect the course of history.”

MARY SOMERVILLE. Science, Illumination, and the Culture of Victorian Britain: establishing science as a distinct, integral, and unifying element of culture. By the time of her death, Somerville had achieved near-mythic status in Britain. Her works reflect both the power of science to capture imagination and the influence of cultural factors in the development of science. They provide a window into a particularly lucid and illuminated mind and into one of the most formative periods in the evolution of modern scientific culture. This retelling of Somerville’s story focuses on the factors that allowed her to become an eminent scientist and argues for rethinking the story of women’s participation in science.”


Approximately forty leading scientists, politicians, senior public servants and journalists from several countries met at Herstmonceux Castle in the United Kingdom to consider how to promote better understanding between scientists and policy-makers by focusing on the issue of science and responsibility. This volume consists of the edited version of the proceedings of the conference.


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