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ANNUAL INDEX

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

CONTENTS

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0033-569X(199612)54:4;1-K

Functional Equations in Several Variables, with Applications to Mathematics, Information Theory and to the Natural and Social Sciences. By J. Aczél and J. Dhombres, Cambridge University Press, 1989, xiii+462 pp., $89.50

This treatise is volume 31 of the *Encyclopaedia of Mathematics and its Applications*, a distinguished series edited by Gian-Carlo Rota. It deals with the modern theory of functional equations in several variables, emphasising applications in addition to theory, and keeping prerequisites to a minimum: calculus, linear algebra, and the basics of Lebesgue integration. Where more advanced topics are needed, references are given and the results carefully explained. The chapters can be read almost independently of each other. There is a chapter on the history of the subject, and an encyclopaedic bibliography of over 1600 items. The scope of the work is indicated by its chapter headings: 1. Axiomatic motivation of vector addition; 2. Cauchy's equation $f(x+y) = f(x) + f(y)$. Hamel basis; 3. Three further Cauchy equations. An application to information theory; 4. Generalizations of Cauchy's equations to several multiplace vector and matrix functions. An application to geometric objects; 5. Cauchy's equations for complex functions. Applications to harmonic analysis and to information measures; 6. Conditional Cauchy equations. An application to geometry and a characterization of the Heaviside functions; 7. Addundancy, extensions, quasi-extensions and extensions almost everywhere. Applications to harmonic analysis and to rational decision making; 8. D'Alembert's functional equation. An application to noneuclidean mechanics; 9. Images of sets and functional equations. Applications to relativity theory and to additive functions bounded on particular sets; 10. Some applications of functional equations in functional analysis, in the geometry of Banach spaces and in valuation theory; 11. Characterizations of inner product spaces. An application to gas dynamics; 12. Some related equations and systems of equations. Applications to combinatorics and Markov processes; 13. Equations for trigonometric and similar functions; 14. A class of equations generalizing d'Alembert and Cauchy Pexider-type equations; 15. A further generalization of Pexider's equation. A uniqueness theorem. An application to mean values. 16. More about conditional Cauchy equations. Applications to additive number theoretical functions and to coding theory; 17. Mean values, mediality and self-distributivity; 18. Generalized mediality. Connection to webs and monograms; 19. Further composite equations. An application to averaging theory; 20. Homogeneity and some generalizations. Applications to economics; 21. Historical notes.

Computer-Intensive Methods for Testing Hypotheses—An Introduction. By Eric W. Noreen, John Wiley and Sons, 1989, ix+229 pp., $24.95

The methods reported here are called computer-intensive, because they require recomputing the test statistic for many (typically 100 to 1000) artificially constructed data sets. Virtually every nonparametric statistical test is a special case of one of the methods. The significance of almost any test statistics can be assessed using one of the methods. There are five chapters. Chapter 1 is introductory. Chapter 2 discusses the approximate randomization method that can be used to test the null hypothesis that one variable is unrelated to another. In Chapter 3 Monte-Carlo sampling is discussed; it can be used to draw inferences concerning a population from which a random sample has been drawn. Bootstrap sampling, which is a special case of Monte Carlo sampling, is discussed in Chapter 4. In Chapter 5 the three major computer-intensive methods for assessing the significance of a test statistic are reviewed and are contrasted with each other and with conventional parametric methods. Appendices give BASIC, FORTRAN, and PASCAL program listings that provide solutions for each of the examples in the text. In addition, a collection of exercises and solutions is available by writing to the author.

Lectures on Buildings. By Mark Ronan, Academic Press, 1989, xiii+201 pp., $27.95

This is not a book on civil engineering. The term "building" is due to Bourbaki, and the theory of buildings was developed mainly by Jacques Tits in the 1950s in an attempt to develop a systematic interpretation of semi-simple Lie groups, particularly the exceptional groups. This book presents an up-to-date account of this theory.

Initial-Boundary Value Problems and the Navier-Stokes Equations. By Heinz-Otto Kreiss and Jens Lorenz, Academic Press, 1989, xi+402 pp., $54.50

This is volume 136 in the series *Pure and Applied Mathematics*. It is its aim to develop a theory of initial-boundary value problems for linear and nonlinear partial differential equations, and to fill the gap between elementary and rather abstract books. To illustrate the theory, the authors have chosen the compressible and incompressible Navier-Stokes equations, a choice dictated by the desire to find a system that is so rich in phenomena that the whole power of the mathematical theory is needed to discuss existence, smoothness, and boundary conditions. The authors develop the theory in the following way, which they claim to be closer to computing than alternative ones: First they show, by using difference approximations for linear problems and linearization for nonlinear problems, that there is a set of C^∞-smooth data, dense in L_2, for which the equations they discuss have C^∞-smooth solutions. These solutions and their derivatives can be estimated in terms of the data. The authors then use the usual closure argument to define weak solutions if the data are less smooth. Chapter headings: 1. The Navier-Stokes equations; 2. Constant-coefficient Cauchy problems; 3. Linear variable-coefficient Cauchy problems in one dimension; 4. A nonlinear example: Burgers' equation; 5. Nonlinear systems in one space dimension; 6. The Cauchy problem for systems in several dimensions; 7. Initial-boundary value problems in one space dimension; 8. Initial-boundary value problems in several space dimensions; 9. The incompressible Navier-Stokes equations: the spatially periodic case; 10. The incompressible Navier-Stokes equations under initial and boundary conditions.

Statistics for Biologists. By R. C. Campbell, Cambridge University Press, 1989, xviii+446 pp.

This is the third edition of a text first published in 1967, second edition in 1974. The main object of the new material in this edition is to illustrate the potential usefulness of computers to biologists engaged in statistical analyses. Computer analyses of a selection of the examples and exercises are given, using several different statistical languages.

Statistical Analysis and Mathematical Modelling of AIDS. Edited by J. C. Jager and E. J. Ruitenberg, Oxford University Press, 1988, xix+167 pp., $56.50

This book contains the methodological studies presented at a workshop on the title subject, held at the National Institute of Public Health and Environmental Hygiene, Bilthoven, The Netherlands, in December 1986. It presents an overview of the main quantitative techniques available five years after the first recognition of AIDS in the USA.

Point Process Models with Applications to Safety and Reliability. By W. A. Thompson, Jr., Chapman and Hall, 1988, xi+146 pp., $39.95

This monograph provides an elementary but rigorous treatment of models for the placement of points on a time axis according to some chance mechanism, assuming a first course in probability theory from the reader. The material presented is particularly useful for reliability, safety analysis, life distributions, and clustering. Its scope is indicated by its chapter headings: 1. Introduction; 2. Point processes; 3. Homogeneous Poisson processes; 4. Application of point processes to a theory of safety assessments; 5. Renewal processes; 6. Poisson processes; 7. Superimposed processes; 8. Markov point processes; 9. Applications of Markov point processes; 10. The order statistics process; 11. Competing risk theory.

Mathematical Introduction to Linear Programming and Game Theory. By Louis Brickman, Springer-Verlag, 1989, ix+130 pp., $34.00

This is a volume in the series *Undergraduate Texts in Mathematics.* Its principal objectives are to define linear programming and its usefulness, to explain the operation and elementary theory of the simplex algorithm, to present duality theory in a simple fashion, and to give a well-motivated account of matrix games. Only elementary notions of probability and sets are assumed. Chapter headings: 1. Simultaneous linear equations; 2. Linear programming foundations; 3. The simplex algorithm; 4. Dual tableaux and two-phase algorithms; 5. Dual LP problems; 6. Matrix games.

Principles of Statistical Radiophysics 3: *Elements of Random Fields.* By Sergei M. Rytov, Yurii A. Kravtsov, and Valeryan I. Tatarskii, Springer-Verlag, 1989, x+239 pp., $99.00

This is a translation, by Alexander P. Repyev, of the original Russian edition published by Nauka, Moscow, in 1978. The two earlier volumes of the set were entitled Elements of Random Process Theory and Correlation Theory of Random Processes, respectively, and the fourth volume will be on Wave Propagation through Random Media. Unlike the preceding two volumes devoted to random functions of one variable, this volume is concerned with the more general case of multi-variate functions, i.e., random fields. The variables are usually time t and spatial coordinates $\mathbf{r} = \{x, y, z\}$. Some problems only involve subsets of these variables. Chapter headings: 1. Fundamentals; 2. Radiation and diffraction of random wave fields; 3. Thermal electromagnetic fields; 4. Single scattering theory.

Noise in Nonlinear Dynamical Systems. Edited by Frank Moss and P. V. E. McClintock, Cambridge University Press, 1989. Volume 1: *Theory of continuous Fokker-Planck systems*, xvi+353 pp., $85.00. Volume 2: *Theory of noise induced processes in special applications*, xviii+388 pp., $85.00; Volume 3: *Experiments and simulations*, xvi+278 pp., $75.00

The purpose of these volumes is twofold. First, the editors hope that their publication will help to stimulate new experimental activity by contrasting the smallness of the number of existing experiments with the many research opportunities raised by the chapters on applications. Secondly, it has been the editors' aim to collect together in one place a complete set of authoritative reviews with contributions representative of all the major practitioners in the field. Although there is a strong underlying theme running through all three volumes—the influence of noise on dynamical systems—each chapter should be considered as a self-contained account of the authors' most important research in the field and can be read either alone or in concert with the others. The early development of the field is reviewed in the nine chapters of volume 1, with treatments confined exclusively to Fokker-Planck systems. There is, for instance, a historical sketch by Rolf Landauer, and a review of Markov methods by a pioneer of the field, R. L. Stratonovich. In an appendix, there is a translation of the classical (1933) paper "On the statistical treatment of dynamical systems" by L. Pontryagin et al. In the thirteen chapters of volume 2, a range of contemporary problems, indicative of the rich diversity of applications of noise-driven dynamics, is reviewed. Though most problems currently treated are classical, recent work on dissipative quantum tunnelling has focused attention on quantum mechanical applications. Credible experimental tests of stochastic theory have been completed on only a relatively small number of natural systems. These include, particularly, superfluid helium, liquid crystals and lasers, whose diverse properties provide the subject matter of Chapters 1–6 of volume 3. In that volume, also, digital simulation techniques are discussed in Chapter 7 and analogue techniques and their application to a wide variety of physical systems in Chapters 8 and 9.

Numerical Solution of Stochastic Differential Equations. By Peter E. Kloeden and Eckhard Platen, Springer-Verlag, 1992, xxxv+632 pp., $59.00

This is volume 23 in the series Applications of Mathematics. The aim of this book is to provide an accessible introduction to stochastic differential equations and their applications, together with a systematic presentation of methods available for their numerical solution, primarily time discretization methods for initial value problems of SDEs with Ito diffusions as their solutions. The book is directed at readers from different fields and backgrounds, such as those interested in modelling and applying standard methods, typically from the social and life sciences and often without a strong background in mathematics; those with a technical background in mathematical methods typical of engineers and physicists interested in developing and implementing new schemes; and those with a stronger, advanced mathematical background, interested in theoretical developments and underlying mathematical issues. The book is written at a level appropriate for a reader with an engineer's or physicist's undergraduate training in mathematical methods. It consists of 17 chapters, which are grouped into 6 parts: Part I. Preliminaries. 1. Probability and Statistics; 2. Probability and stochastic processes. Part II. Stochastic Differential Equations. 3. Ito stochastic calculus; 4. Stochastic differential equations; 5. Stochastic Taylor expansions. Part III. 6. Modelling with stochastic differential equations; 7. Applications of stochastic differential equations. Part IV. 8. Time discrete approximation of deterministic differential equations. Part V. 9. Strong Approximations. 10. Strong Taylor approximations; 11. Explicit strong approximations; 12. Implicit strong approximations; 13. Selected applications of strong approximations. Part VI. Weak Approximations. 14. Weak Taylor approximations; 15. Explicit and implicit weak approximations; 16. Variance reduction methods; 17. Selected applications of weak approximations.

Spectral Analysis for Physical Applications: Multitaper and Conventional Techniques. By Donald B. Percival and Andrew T. Walden, Cambridge University Press, 1993, xxvi+583 pp., $89.95 (hard cover), $39.95 (paper)

It was the intention of the authors when writing this book to provide a graduate-level introduction to spectral analysis that covers both well-accepted methods and some important recent advances. Special emphasis is placed on the multitaper technique due to D. J. Thompson (1982) because of its potential for routinely handling spectra with intricate structure. Some additional distinctive features of this book are: a thorough review of the necessary Fourier theory; attention to computational considerations; the new statistical techniques for sinusoids; a large number of exercises, of varying levels of difficulty. A complementary volume is currently under preparation and will include topics such as spectral analysis of multivariate time series, higher-order spectra, spectral estimation for irregularly sampled time series, robust spectral estimation, spectral ratios, and the simulation of stationary stochastic processes. Chapter headings: 1. Introduction to spectral analysis; 2. Stationary stochastic processes; 3. Deterministic spectral analysis; 4. Foundations for stochastic spectral analysis; 5. Linear time-varying filters; 6. Nonparametric spectral estimation; 7. Multitaper spectral estimation; 8. Calculation of discrete prolate spheroidal sequences; 9. Parametric spectral estimation; 10. Harmonic analysis.

Birth and Death Processes and Markov Chains. By Wang Zikun Yang Xiangqun, Springer-Verlag, 1992, xx+361 pp., $109.00

The objective of this book is to describe the fundamental theory of birth-death processes and Markov chains and to present recent developments. By Markov chain is here meant a time-homogeneous Markov process with continuous time parameters and countably many states. Chapter headings: 1. General concepts of stochastic processes; 2. Analytic theory of Markov chains; 3. Properties of sample functions; 4. Basic theory of birth and death processes; 5. Construction theory of birth and death processes; 6. Analytic construction of birth and death processes; 7. Bilateral birth and death processes.

Numerical Methods for Stochastic Control Problems in Continuous Time. By Harold J. Kushner and Paul G. Dupuis, Springer-Verlag, 1992, ix+439 pp., $49.00

This book is concerned with numerical methods for stochastic control and optimal stochastic control problems. The random process models of the controlled or uncontrolled stochastic systems are either diffusions or jump diffusions. The class of methods dealt with is referred to generically as the *Markov chain approximation method*, developed initially in the first author's 1977 book. Its basic idea is to approximate the original controlled process by an appropriate Markov chain on a finite state space. The book is written on two levels, so that the methods of actual approximation and practical use of the algorithms can be read without an involvement with the mathematics of the convergence proofs. Chapter headings: 1. Review of continuous time models; 2. Controlled Markov chains; 3. Dynamic programming equations; 4. The Markov chain approximation method: Introduction; 5. Construction of the approximating Markov chain; 6. Computational methods for controlled Markov chains; 7. The ergodic cost problem: Formulations and algorithms; 8. Heavy traffic and singular control problems: Examples and Markov chain approximations; 9. Weak convergence and the characterization of processes; 10. Convergence proofs; 11. Convergence for reflecting boundaries, singular control and ergodic cost problems; 12. Finite time problems and nonlinear filtering; 13. Problems from the calculus of variations; 14. The viscosity solution approach to proving convergence of numerical schemes.

Efficient and Adaptive Estimation for Semiparametric Models. By Peter J. Bickel, Chris A. J. Klaassen, and Jon A. Wellner, The Johns Hopkins University Press, 1993, xix+560 pp., $95.00

This is a volume in the Johns Hopkins Series in the Mathematical Sciences. It is concerned with estimation in situations when it is believed that one has enough knowledge to model some features of the data parametrically, is unwilling to assume anything for other features. For example, in the two-sample case of the Cox proportional hazards model, one might assume that the treatment effect can be modeled multiplicatively (parametrically) on some completely unknown scale. The theory of the nonlinear estimation procedures necessary in these cases is based on asymptotic approximations, while actual performance for finite sample sizes is often gauged by simulation. The focus of the book is, therefore, on asymptotic theory, applied to models for independent, identically distributed observations. The authors' goals are: to show how the information bounds and methods of estimation developed here can be viewed as natural extensions of the classical parametric model context; to apply these techniques in a broad range of models; to develop the theory of information bounds for estimation of infinite-dimensional parameters; and to develop a coherent heuristic view of the methods used in semiparametric estimation. Chapter headings: 1. Introduction; 2. Asymptotic inference for (finite-dimensional) parametric models; 3. Information bounds for Euclidean parameters in infinite-dimensional models; 4. Euclidean parameters: further examples; 5. Information bounds for infinite-dimensional parameters; 6. Infinite-dimensional parameters: further examples; 7. Construction of estimates.

Solving Ordinary Differential Equations I-Nonstiff Problems. By E. Hairer, S. P. Norsett, and G. Wanner, Springer-Verlag, 1993, xv+528 pp., $98.00

This is the second revised edition of a text first published in 1987. It is volume 8 in the Springer Series in Computational Mathematics. New material has been included on the following topics: Hamiltonian systems and symplectic Runge-Kutta methods, dense output for Runge-Kutta and extrapolation methods, a new Dormand and Prince method of order 8 with dense output, parallel Runge-Kutta methods, and numerical tests for first- and second-order systems. This volume has again three chapters, one on classical mathematical theory, one on Runge-Kutta and extrapolation methods, and one on multistep methods and general linear methods, with each chapter divided into many sections.

Regression Analysis—Theory, Methods and Applications. By Ashish Sen and Muni Srivastava, Springer-Verlag, 1990, ix+347 pp.

This is a volume in the series Springer Texts in Statistics. It is based on a semester-long course given in Toronto to juniors, seniors, and graduate students in a variety of fields. It has twelve chapters. The Gauss-Markov conditions are assumed to hold in the first four chapters. The next five chapters present methods to alleviate the effects of violation of these conditions. The final three chapters discuss multicollinearity, variable search, and biased estimation. A disk containing most of the 50 data sets from the exercises and examples is included with the book. Chapter headings: 1. Introduction; 2. Multiple regression; 3. Tests and confidence regions; 4. Indicator variables; 5. The normality assumption; 6. Unequal variances; 7. Correlated errors; 8. Outliers and influential observations; 9. Transformations; 10. Multicollinearity; 11. Variable selection; 12. Biased estimation. Appendices: A. Matrices; B. Random variables and random vectors; C. Nonlinear least squares.

Sampling. By Steven K. Thompson, John Wiley and Sons, 1992, xv+343 pp.

This is a volume in the Wiley Series in Probability and Mathematical Statistics. It covers the basic sampling design and estimation methods and gives special attention to methods for populations that are inherently difficult to sample, elusive, rare, clustered, or hard to detect. The twenty-six chapters are organized into six parts. Part I covers basic sampling from simple random sampling to unequal probability sampling. Part II treats the use of auxiliary data with ratio and regression estimation and looks at the ideas of sufficient data and of model and design in practical sampling. Part III covers major useful designs, including stratified, cluster, systematic, multistage, double, and network sampling. Part IV examines detectability methods for elusive populations. Part V concerns spatial sampling, with the prediction or "kringing" methods of geostatistics, considerations of efficient spatial designs, and comparisons of different observational methods including plot shapes and detection aspects. Part VI introduces adaptive sampling designs, in which the sampling procedure depends on what is observed during the survey.

Statistical Analysis of Behavioural Data—An Approach Based on Time-Structured Models. By Patsy Haccou and Evert Meelis, Oxford University Press, 1992, xvii+396 pp.

This book differs from other books on quantitative methods in behavioural science in that the methods are based on explicit models of the time structure of behaviour, i.e., stochastic processes which are characterized by parameters that can easily be interpreted as the tendency to switch from one act to another. It is concerned with the statistical analysis of transition data. The discussion begins with the continuous-time Markov chain and several of its generalizations which have recently been applied in ethological research. Chapter headings: 1. Introduction; 2. Preliminary inspection of the observations; 3. Analysis of time inhomogeneity; 4. Tests for exponentiality; 5. Tests of sequential dependency properties; 6. Simultaneous tests; 7. Analysis based on a (semi-) Markov description; 8. Examples of analyses based on continuous-time Markov chain modeling.

Bayesian Statistics 4. Edited by J. M. Bernardo, J. O. Berger, A. P. Dawid, and A. F. M. Smith, Oxford University Press, 1992, xiii+859 pp., $75.00

This volume in the series Oxford Science Publications constitutes the Proceedings of the Fourth Valencia International Meeting on Bayesian Statistics, held April 15–20, 1991; it is dedicated to the memory of Morris H. DeGroot. It includes the texts of 30 invited papers (with discussion), of which the first is the keynote address by Dennis V. Lindley, entitled: Is our view of Bayesian Statistics too narrow? It also includes the text of 33 contributed papers.

An Introduction to Probability and Stochastic Processes. By Marc A. Berger, Springer-Verlag, 1992, xii+205 pp., $39.00

This is a volume in the series Springer Texts in Statistics. It is based on a "nonmeasure theoretic" course taught by the author several times at the Weizmann Institute. The material can be grouped into four categories. The first two chapters deal with the theory of random variables and distributions. The third chapter covers basic limit theorems. Chapters four, five, and six cover discrete and continuous-time Markov processes (passage phenomena, stationary distributions and steady states of Markov chains, Markov jump processes). Chapter seven covers products of random matrices and their application to the generation of fractals.

Annual Review of Fluid Mechanics, Volume 25, 1993. Edited by John L. Lumley, Milton Van Dyke, and Helen L. Reed, Annual Reviews Inc., Palo Alto, California, 1993, 641 pp., $44.00

This year, the featured classical figure is Jean Leonard Marie Poiseuille (1797–1869). There are a frontispiece and a lead article "The History of Poiseuille's Law" by Salvatore P. Sutera and Richard Skalak. There are sixteen additional review articles, balancing (in the words of the editors) theory and applications; mathematics, computation and experiment; the various branches of engineering and physics; and trendiness and tradition. It is again a very successful blend.

Large Sample Methods in Statistics—An Introduction with Applications. By Pranab K. Sen and Julio M. Singer, Chapman and Hall, 1993, xii+382 pp., $59.95

The authors observe that for the justification for approximate methods in modern applications, the traditional convergence discussion (based on the first four moments to those of the normal distribution) is no longer sufficient and techniques based on characteristic functions are required. This is particularly true if one moves from the i.i.d. case to dependent observations, such as survival analysis and life tables. Here, an understanding of topics such as martingale structures is advantageous, but often beyond the reach of the reader. This book is intended to cover this gap by providing a solid justification for such asymptotic methods, although at an intermediate level. Its scope is apparent from the table of contents: 1. Objectives and scope: general introduction; 2. Stochastic convergence; 3. Weak convergence and general limit theorems; 4. Large sample behaviour of empirical distributions and order statistics; 5. Asymptotic behaviour of estimators and test statistics; 6. Large sample theory for categorical data models; 7. Large sample theory for regression models; 8. Invariance principles in large sample theory.

Statistical Theory. By Bernard W. Lindgren, Chapman and Hall, 1993, xii+633 pp., $57.95

This is the fourth edition of the well-known text. It is intended for a year's course in the theory of statistics. A good command of first-year calculus as well as some knowledge of multivariable calculus and linear algebra are assumed. The material covered in earlier editions is retained since it remains important as a foundation, but certain material that made the text seem more formidable than it was has been eliminated. Statistical decision theory is now deferred to the last chapter, but the Bayesian approach is introduced earlier. The number of problems for the student has been increased by about forty percent. An instructor's manual, with problem solutions and additional problems, will be available.

Alternative Methods of Regression. By David Birkes and Yadolah Dodge, John Wiley and Sons, 1993, xii+228 pp., $49.95

This is a volume in the Wiley Series in Probability and Mathematical Statistics. It discusses approaches to regression analysis alternative to the classical least squares approach. Chapters 1 and 2 deal with the general idea of linear regression without specifying any particular method. Chapter 3 is a review of least-squares regression. Chapters 4 through 8 present five alternative methods: least-absolute-deviations, robust M-, nonparametric rank-based, Bayesian, and ridge regression. In chapter 9 these methods are compared, and in chapter 10 a number of other methods are briefly mentioned.

Glimpses of India's Statistical Heritage. Edited by J. K. Ghosh, S. K. Mitra, and K. R. Parthasarathy, John Wiley and Sons, 1993, ix+293 pp., $34.95

This volume contains articles of reminiscences of the distinguished history of statistics in India by R. R. Bahadur, D. Basu, V. S. Huzurbazar, G. Kallianpur, D. B. Lahiri, P. R. Masani, K. R. Nair, C. R. Rao, S. S. Shrikhande, and P. V. Sukhatme.

Functional and Numerical Methods in Viscoplasticity. By Ioan R. Ionescu and Mircea Sofonea, Oxford University Press, 1993, xvii+265 pp., $85.00

This a volume in the series Oxford Science Publications. Its contents reflect extensions of original research work of the authors, and are addressed to students and researchers interested in the mathematical and numerical problems of nonlinear mechanics and its extensions; they cover the gamut from the formulation of the mathematical model to its numerical solution. Theoretical results, concerning existence, uniqueness, and behavior of solutions, as well as numerical approaches and some engineering applications are presented. The book is intended to be self-contained and accessible to a wide range of readers. Chapter headings: 1. Preliminaries on mechanics of continuous media; 2. Functional spaces in viscoplasticity; 3. Quasistatic processes for rate-type viscoplastic materials; 4. Dynamic processes for rate-type elastic-viscoplastic materials; 5. The flow of the Bingham fluid with friction.

Operator-Limit Distributions in Probability Theory. By Zbigniew J. Jurek and J. David Mason, John Wiley and Sons, 1993, xiii+292 pp., $79.95

This is a volume in the Wiley Series in Probability and Mathematical Statistics. The theory of limit distributions describes limit phenomena of triangular series or sequences of independent random observations. The main aims for this book are to present a theory of limit distributions of sequences of Banach space valued random vectors, present "coordinate-free" proofs, and indicate the essential differences for infinite-dimensional Banach space valued random variables. Chapter headings: 1. Preliminaries; 2. Convergence of types theorems, symmetry groups, and decomposability semigroups; 3. Operator-selfdecomposable measures; 4. Operator-stable measures.

Kinetic Theory of Living Patterns. By Lionel G. Harrison, Cambridge University Press, 1993, xix+354 pp., $69.95

This is volume 28 in the Developmental and Cell Biology Series. It is concerned with theories of the development of the shapes of living organisms and their parts, and in particular with the dichotomy of views. It contains an extensive philosophical commentary on the dichotomy between the views of physical scientists and experimental biologists. In particular, it contains an extensive philosophical commentary on this dichotomy in views and an exposition of the type of theory most favored by physical scientists. In this theory, living form is a manifestation of the dynamics of chemical change and physical transport or other physics of spatial communication. The reaction-diffusion theory, as initiated by Turing in 1952 and elaborated upon by Prigogine, Gierer and Meinhardt, and others, is discussed in detail. The mathematical background required of the reader is no more than a good first course in calculus. Chapter headings: Part I: Macroscopics without mathematics. 1. Introduction; 2. Morphogen: one word for at least two concepts; 3. Pictorial reasoning in kinetic theory of pattern and form; 4. Structure, equilibrium, kinetics; Part II: Pattern-forming processes. 5. The making and breaking of symmetry; 6. Matters needing mathematics: An introduction; 7. Kinetic models for stable pattern: An introduction; Part III: Bringing experiment and theory together. 8. Classifications; 9. Nonlinear reaction-diffusion models; 10. Approaching agreement?

The Statistical Mechanics of Lattice Gases, Volume I. By Barry Simon, Princeton University Press, 1993, xi+522 pp., $69.50

This is a volume in the Princeton Series in Physics. Together with its second volume, this work will represent a state-of-the-art survey of both classical and quantum lattice gas models, covering the rigorous mathematical studies of such models as the Ising and Heisenberg. This first volume addresses the mathematical background on convexity and Choquet theory and presents an exhaustive study of the pressure including the Onsager solution of the two-dimensional Ising model, a study of the general theory of states in classical and quantum systems, and a study of high and low temperature expansions. The second volume will deal with the Peierls construction, infrared bounds, Lee-Yang theorems, and correlation inequality. Chapter headings: 1. Preliminaries; 2. The pressure; 3. States: the classical case; 4. States: the quantum case; 5. High temperature and low densities.

Statistics for Spatial Data. By Noel A. C. Cressie, John Wiley and Sons, 1993, xx+900 pp., $89.95

This volume in the Wiley Series in Probability and Mathematical Statistics is a revised edition of the work first published in 1991. It is a comprehensive guide to both the theory and the applied aspects of current spatial statistical methods. After an introductory chapter, the remaining chapters are divided into three parts: geostatistical data (2–5), lattice data (6–7), spatial patterns (8–9); shedding light on the link between data and model, revealing how design, inference, and diagnostics are an outgrowth of that link. It then explores new methods to show how spatial statistical models can be used to solve problems in a variety of disciplines. Chapter headings: 1. Statistics for spatial data; 2. Geostatistics; 3. Spatial statistics and kringing; 4. Applications of geostatistics; 5. Special topics in statistics for spatial data; 6. Spatial models on lattices; 7. Inference for lattice models; 8. Spatial point patterns; 9. Modeling objects.

Advanced Calculus with Applications in Statistics. By André I. Khuri, John Wiley and Sons, 1993, xiii+466 pp., $49.95

This is a volume in the Wiley Series in Probability and Mathematical Statistics. It has two purposes. The first is to provide beginning graduate students in statistics with the basic concepts of advanced calculus. The second purpose is to serve as a text for juniors and seniors majoring in mathematics, for which it is suitable because of its rigorous and thorough coverage of advanced calculus. The following is the list of chapter headings; in each chapter, the last section presents the statistical applications of the topics covered in that chapter. 1. An introduction to set theory; 2. Basic concepts in linear algebra; 3. Limits and continuity of functions; 4. Differentiation; 5. Infinite sequences and sets; 6. Integration; 7. Multidimensional calculus; 8. Optimization in statistics; 9. Approximation of functions.

Experts in Uncertainty—Opinion and Subjective Probability in Science. By Roger M. Cooke, Oxford University Press, 1991, ix+321 pp., $65.00

This is a volume in the Environmental Ethics and Policy Series. It is, broadly speaking, about the speculations, guesses, and estimates of people who are considered experts, in so far as these serve as "cognitive input" in some decision process. The questions studied include how expert opinion is in fact being used today, how an expert's uncertainty is or should be represented, how people do or should reason with uncertainty, how the quality and usefulness of expert opinion can be assessed, and how the views of several experts might be combined. The subject matter of this book therefore overlaps disciplines from philosophy through policy analysis up to some rather technical mathematics. In particular, the authors are interested in developing practical models with a mathematical foundation for using expert opinion in science. The sixteen chapters are divided into three parts: experts and opinions, subjective probability, combining expert opinions.

Non-classical Elastic Solids. By M. Ciarletta and D. Iesan, Longman Scientific and Technical, 1993, 346 pp., $74.95

This is a volume in the Pitman Research Notes in Mathematics Series. It consists of three parts: in the first part (chapters 1–3) are presented results concerning the initial-boundary-value problems of the theory of nonsimple elastic bodies. The second part (chapters 4–6) contains a study of the elastic solids with microstructure. The third part is concerned with the theory of elastic materials with voids. Chapter headings: 1. The nonlinear theory of nonsimple elastic bodies; 2. Linear elastodynamics; 3. Equilibrium theory; 4. Elastic solids with microstructure; 5. Elastostatics; 6. The dynamic theory; 7. Elastic materials with voids; 8. Problems for nonlinearly elastic materials with voids.

Modeling, Estimation and Control of Systems with Uncertainty. Edited by Giovanni B. DiMasi, Andrea Gombani, and Alexander B. Kurzhansky, Birkhäuser, 1991, vii+467 pp., $98.50

This is volume 10 in the series Progress in Systems and Control Theory. It constitutes the Proceedings of a Conference held in Sopron, Hungary, September 1990. There are 31 papers. The methods discussed include some in which the model is formulated in terms of stochastic processes and others in terms of set-valued dynamics.

Applied Optimal Control Theory of Distributed Systems. By K. A. Lurie, Plenum Press, 1993, xii+499 pp., $95.00

This is volume 43 in the series Mathematical Concepts and Methods in Science and Engineering. It is a substantially revised and updated version of the author's earlier work *Optimal Control in Problems of Mathematical Physics*, published in Russian in 1975. It features discussion of the existence of optimal controls in the context of Pontryagin's maximum principle and examines the latest results obtained in the problem of the optimal design of nonhomogeneous bodies. Chapter headings: 1. Introduction; 2. The Mayer-Bolza problem for several independent variables: necessary conditions for a minimum; 3. Optimal distribution of the resistivity of the working medium in the channel of a magnetohydrodynamic generator; 4. Relaxation of optimization problems with equations containing the elliptic operator of second order: an application to the problem of elastic torsion; 5. Relaxation of some problems in the optimal design of plates; 6. Optimal control of systems described by equations of hyperbolic type; 7. Parabolic and other evolution optimization problems; 8. Bellman's method in variational problems with partial derivatives.

Biological Kinetics. Edited by Lee A. Segel, Cambridge University Press, 1992, x+220 pp., $54.95

This is volume 12 in the series Cambridge Studies in Mathematical Biology. It is a collection of 11 articles which originally appeared as part of *Mathematical Models in Molecular and Cellular Biology* (C.U.P. 1980, Lee A. Segel, ed.), which is now out of print. The central purpose of the book is to illustrate the premise that examination of the kinetics (time course) of biological processes can give valuable information concerning the underlying mechanisms that are responsible for these processes. Considerable material concerns steady-state solutions. On the molecular level, the discourse ranges from fairly classical analyses of cooperativity in protein binding and enzyme action, through studies of enzyme induction and recepter-effector coupling, to theories for biochemical oscillations in yeast and slime mold. In addition, an introduction to the theoretical topic of chaos concludes with references that chronicle tentative attempts to apply chaos theory in physiology (cardiac dynamics and immunology).

Introduction to Multiple Time Series Analysis. By Helmut Lütkepohl, Springer-Verlag, 1993, xxi+545 pp., $49.00 (paper)

This is the second, corrected, edition of the book first published in 1991. It is written on a mathematical level which should make it accessible to graduate students in business and economics, and examples and exercises are chosen with such students in mind. Chapters 1–9 constitute an introduction to vector autoregressive mixed autoregressive moving average models. Chapter 10 briefly reviews econometric dynamic simultaneous equation models; chapter 11 considers the topic of cointegration; in chapter 12 models with systematically varying coefficients are treated, and state space models are discussed in chapter 13. Spectral methods are not discussed in the book. Chapter headings: 1. Introduction; Part I: Finite order vector autoregressive processes. 2. Stable vector AR processes; 3. Estimation of vector AR processes; 4. Vector AR order selection and checking model adequacy; 5. Vector AR processes with parameter constraints; Part II: Infinite order autoregressive processes. 6. Vector ARMA processes; 7. Estimation of vector ARMA processes; 8. Specification and checking the adequacy of vector ARMA models; 9. Fitting finite order vector AR models to infinite order processes; Part III: Systems with exogeneous variables and nonstationary processes. 10. Systems of dynamic simultaneous equations; 11. Nonstationary systems with integrated and cointegrated variables; 12. Periodic vector AR processes and intervention models; 13. State space models.

Methods in Computational Molecular Physics. Edited by Stephen Wilson and Geerd H. F. Diercksen, Plenum Press, 1992, xiv+551 pp., $135.00

This is volume 293 of the NATO Advanced Science Institutes Series, Series B: Physics. It records the lectures given at a NATO Advanced Study Institute held in Bad Windsheim, Germany, from 22nd July until 2nd August, 1991. The Institute sought to bridge the gap between the presentation of molecular electronic structure theory in contemporary monographs and the realization of the sophisticated algorithms required for its practical application. It sought to underline the relation between the electronic structure problem and the study of nuclear motion. The introductory article by R. McWeeny gives a broad overview of molecular quantum mechanics and provides the background for the 17 contributions that follow.

Mathematical Morphology in Image Processing. Edited by Edward R. Dougherty, Marcel Decker, 1993, xvi+552 pp., $160.00

This is volume 34 in the Optical Engineering Series. It is dedicated to Georges Matheron, with the words "whose seminal volume *Random Sets and Integral Geometry* set forth the epistemological, topological, algebraic, and probabilistic principles for morphological image analysis." The papers in the volume represent the various disciplines that are presently contributing to the field: nonlinear statistics, logic, geometry, geometrical probability, topology, algebraic systems such as lattices and groups. The contributions can be roughly placed within five active areas of research: Chapters 1–3 are statistical, dealing with approaches to finding well-performing structuring elements and the statistical analysis of morphological operations as noise filters. Chapters 4, 5, and 11 concern morphological feature generation for classification. Chapters 6, 7, and 13 concern extension of the morphological paradigm and they illustrate the degree to which mathematical morphology provides promising ground for algebraists. Chapters 8, 9, and 10 treat topics having to do with efficient morphological algorithms, and chapter 12 describes a key paradigm for morphological image segmentation. Each chapter is self-contained.

Topics in Statistical Methodology. By Suddhendu Biswas, John Wiley and Sons, 1991, xvi+611 pp.

This is a text addressed to advanced undergraduate and graduate students of statistics. In the course of covering the traditional topics, the book presents some unusual topics, such as parametric, non-parametric, Bayesian and sequential inference procedures for truncated and censored distributions, as well as Pearson curves, Gram-Charlier series, and orthogonal polynomials.

Fourier Integrals in Classical Analysis. By Christopher D. Sogge, Cambridge University Press, 1993, viii+236 pp., $39.95

This volume in the Cambridge Tracts in Mathematics is an advanced monograph concerned with modern treatments of central problems in harmonic analysis. The main theme of the book is the interplay between ideas used to study the propagation of singularities for the wave equation and their counterparts in classical analysis. Using microlocal analysis, the author studies problems involving maximal functions and Riesz means using the so-called half-wave operator. Chapter headings: 0. Background; 1. Stationary phase; 2. Non-homogeneous oscillatory integral operators; 3. Pseudo-differential operators; 4. The half-wave operator and functions of pseudo-differential operators; 5. L^p estimates of eigenfunctions; 6. Fourier integral operators; 7. Local smoothing of Fourier integral operators.

Modelling Biological Populations in Space and Time. By Eric Renshaw, Cambridge University Press, 1993, xvii+403 pp., $29.95 (paper)

This is the first paperback edition of volume 11 in the series Cambridge Studies in Mathematical Biology, first published in 1991. It develops an approach to the study of the dynamic behaviour exhibited by many species of plants, insects and other animals that unifies two approaches: that by theoreticians who model purely in terms of sophisticated mathematical equations, and biologists who develop simple deterministic models, reluctant to accept stochastic ideas. The authors show that both deterministic and stochastic models have important roles to play and should therefore be considered together; and they construct simple model-based computer simulation procedures which provide insight into the underlying generating mechanism, highlight hitherto unforeseen features of a process and thereby suggest further profitable lines of biological investigation. They advocate the view that the environment has a spatial dimension, since individual population members rarely mix homogeneously over the territory available to them but develop instead within separate sub-regions. Chapter headings: 1. Introductory remarks; 2. Simple birth-death process; 3. General birth-death process; 4. Time-lag models of population growth; 5. Competition processes; 6. Predator-prey processes; 7. Spatial predator-prey systems; 8. Fluctuating environments; 9. Spatial population dynamics; 10. Epidemic processes; 11. Linear and branching architectures.

Modern Heuristic Techniques for Combinatorial Problems. Edited by Colin R. Reeves, John Wiley and Sons, 1993, xiii+320 pp.

This book is designed to be a comprehensive review of some of the more recently developed strategies implementing heuristic techniques. All these techniques have been inspired to some sense by the realization that attempting to imitate natural processes can bring valuable insights to the problem of combinatorial optimization. The articles are by John Beasly, Kathryn Dowsland, Fred Glover, Manual Laguna, Carsten Peterson, Colin Reeves, Bo Söderberg, and their headings are, respectively, Introduction, simulated annealing, Tabu search, genetic algorithms, artificial neural networks, Lagrangian relaxation, evaluation of heuristic performance.

Nonlinear Parabolic and Elliptic Equations. By C. V. Pao, Plenum Press, 1992, xv+777 pp., $125.00

This book is intended to give a systematic treatment of the basic mathematical theory and constructive methods for a class of nonlinear parabolic and elliptic differential equations as well as their applications to various reaction-diffusion problems. The mathematical problems under consideration include scalar boundary-value problems of parabolic and elliptic equations, integroparabolic and integroelliptic boundary-value problems, and coupled systems of parabolic and elliptic equations. The boundary conditions for these equations may be linear or nonlinear, including nonlinear boundary conditions of integral type. The fundamental approach to all of these problems is the method of upper and lower solutions and the associated monotone iterations. This approach leads not only to the basic results of existence, uniqueness, and multiplicity of solutions, but also to various qualitative properties of the solution through suitable construction of upper and lower solutions. This method is also adaptable to constructing numerical solutions of the corresponding discrete systems. Extensive discussion is also given to the stability analysis and the asymptotic behaviour of time-dependent solutions, and attention is given to models arising in ecology, biochemistry, enzyme kinetics, combustion theory, and chemical and nuclear engineering. A special topic is the finite-time blow-up problem for parabolic equations. The book consists of twelve chapters; the first seven chapters treat the scalar parabolic and elliptic boundary-value problems and the remaining five chapters are concerned with coupled systems of parabolic and elliptic equations.

Nonlinear Dynamics, Chaos and Econometrics. Edited by M. Hashem Pesarian and Simon M. Potter, John Wiley and Sons, 1993, xiii+244 pp., $55.00

This book, a special publication of the *Journal of Applied Econometrics*, consists of an introduction by the editors and fourteen papers on various aspects of nonlinear time series analysis in economics. Recently, economic theorists have examined whether nonlinearity in the specification of a deterministic economy can produce solution paths that appear "random" to traditional linear techniques. This volume consists of contributions by leading researchers to this emerging field. The chapter headings are: 1. Complex economic dynamics: obvious in history, generic in theory, elusive in data; 2. Using the correlation exponent to decide whether an economic series is chaotic; 3. Lyapunov exponents as a nonparametric diagnostic for stability analysis; 4. The likelihood ratio test under nonstandard conditions: testing the Markov switching model of GNP; 5. Merger waves and the structure of merger and acquisition time series; 6. Nonlinear dynamics in a structural model of employment; 7. Characterizing nonlinearities in business cycles using smooth transition autoregressive models; 8. Forecast improvements using a volatility index; 9. Multivariate nearest-neighbour forecasts of EMS exchange rates; 10. Nonlinear time-series analysis of stock volatilities; 11. Threshold arch models and asymmetries in volatility; 12. News effects in a high-frequency model of the sterling-dollar exchange; 13. Intra-day futures price volatility: information effects and variance persistence; 14. The comparative power of the TR test against simple threshold models.

Chaotic Dynamics—Theory and Practice. Edited by T. Bounti, Plenum Press, 1992, xii+418 pp., $110.00

This is volume 298 in the NATO Advanced Science Institutes Series B: Physics. It contains the proceedings of a NATO advanced Research Workshop held July 11–20, 1991, in Patras, Greece, which brought together scientists representing many of the different aspects of chaotic dynamics. There are 37 papers, divided into two parts, those on theory and those on practice. Within the theoretical papers, there are four general areas with 3–5 papers in each: (i) complexity, control and data representation; (ii) fractals, multifractals and analyticity of normal forms; (iii) integrability, Painlevé property and singularity analysis; (iv) statistical physics, celestial mechanics and cosmology. The "practical" papers are divided into four groups with 5–7 papers in each: (i) controlling dynamical systems; (ii) semiconductors, superconductors, lasers and electronic circuits; (iii) biology, chemistry, atmospheric and magnetospheric dynamics; (iv) Hamiltonian dynamics, dissipative dynamics and normal forms.

Measure Theory. By J. L. Doob, Springer-Verlag, 1994, xii+210 pp., $49.00

This is volume 143 in the series Graduate Texts in Mathematics. In this very personal monograph, written with verve and a perspective gained from the vantage point of great original achievement, the author stresses the following points: (i) the application of pseudometric, rather than metric, spaces, which obviates the artificial replacement of functions by equivalence classes, a replacement that makes the use of "almost everywhere" either improper or artificial. (ii) Probability concepts are introduced in their appropriate place, not consigned to a "ghetto", since mathematical probability is an important part of measure theory and offers a wide range of measure-theoretic examples and applications both in and outside pure mathematics. (iii) Convergence of sequences of measures is treated both in the general Vitali-Hahn-Saks setting and in the mathematical setting of Borel measures on the metric spaces of classical analysis. Chapter headings: 0. Conventions and notation; 1. Operations on sets; 2. Classes of subsets of a space; 3. Set functions; 4. Measure spaces; 5. Measurable functions; 6. Integration; 7. Hilbert space; 8. Convergence of measure sequences; 9. Signed measures; 10. Measures and functions of bounded variation on $\mathbf{R}$; 11. Conditional expectations, martingale theory.