This text is designed for an introductory probability course at the university level for sophomores, juniors, and seniors in mathematics, physical and social sciences, engineering, and computer science. It presents a thorough treatment of ideas and techniques necessary for a firm understanding of the subject. The text is also recommended for use in discrete probability courses. The material is organized so that the discrete and continuous probability discussions are presented in a separate, but parallel, manner. This organization does not emphasize an overly rigorous or formal view of probability and therefore offers some strong pedagogical value. Hence, the discrete discussions can sometimes serve to motivate the more abstract continuous probability discussions. Features: Key ideas are developed in a somewhat leisurely style, providing a variety of interesting applications to probability and showing some nonintuitive ideas. Over 600 exercises provide the opportunity for practicing skills and developing a sound understanding of ideas. Numerous historical comments deal with the development of discrete probability. The text includes many computer programs that illustrate the algorithms or the methods of computation for important problems. The book is a beautiful introduction to probability theory at the beginning level. The book contains a lot of examples and an easy development of theory without any sacrifice of rigor, keeping the abstraction to a minimal level. It is indeed a valuable addition to the study of probability theory. --Zentralblatt MATH

Supported by a wealth of learning features, exercises, and visual elements as well as online video tutorials and interactive simulations, this book is the first student-focused introduction to Bayesian statistics. Without sacrificing technical integrity for the sake of simplicity, the author draws upon accessible, student-friendly language to provide approachable instruction perfectly aimed at statistics and Bayesian newcomers. Through a logical structure that introduces and builds upon key concepts in a gradual way and slowly acclimatizes students to using R and Stan software, the book covers: An introduction to probability and Bayesian inference Understanding Bayes' rule Nuts and bolts of Bayesian analytic methods Computational Bayes and real-world Bayesian analysis Regression analysis and hierarchical methods This unique guide will help students develop the statistical confidence and skills to put the Bayesian formula into practice, from the basic concepts of statistical inference to complex applications of analyses.

This integrated introduction to fundamentals, computation, and software is your key to understanding and using advanced Bayesian methods.

Praise for the first edition: Principles of Uncertainty is a profound and mesmerising book on the foundations and principles of subjectivist or behaviourist Bayesian analysis. the book is a pleasure to read. And highly recommended for teaching as it can be used at many different levels. A must-read for sure! —Christian Robert, CHANCE It's a lovely book, one that I hope will be widely adopted as a course textbook. —Michael Jordan, University of California, Berkeley, USA Like the prize-winning first edition, Principles of Uncertainty, Second Edition is an accessible, comprehensive text on the theory of Bayesian Statistics written in an appealing, inviting style, and packed with interesting examples. It presents an introduction to the subjective Bayesian approach which has played a pivotal role in game theory, economics, and the recent boom in Markov Chain Monte Carlo methods. This new edition has been updated throughout and features new material on Nonparametric Bayesian Methods, the Dirichlet distribution, a simple proof of the central limit theorem, and new problems. Key Features: First edition won the 2011 DeGroot Prize Well-written introduction to theory of Bayesian statistics Each of the introductory chapters begins by introducing one new concept or assumption Uses "just-in-time mathematics"—the introduction to mathematical ideas just before they are applied
A self-contained introduction to probability, exchangeability and Bayes’ rule provides a theoretical understanding of the applied material. Numerous examples with R-code that can be run "as-is" allow the reader to perform the data analyses themselves. The development of Monte Carlo and Markov chain Monte Carlo methods in the context of data analysis examples provides motivation for these computational methods.

Introduces the increasingly popular Bayesian approach to statistics to graduates and advanced undergraduates. In contrast to the long-standing frequentist approach to statistics, the Bayesian approach makes explicit use of prior information and is based on the subjective view of probability. Bayesian econometrics takes probability theory as applying to all situations in which uncertainty exists, including uncertainty over the values of parameters. A distinguishing feature of this book is its emphasis on classical and Markov chain Monte Carlo (MCMC) methods of simulation. The book is concerned with applications of the theory to important models that are used in economics, political science, biostatistics, and other applied fields. These include the linear regression model and extensions to Tobit, probit, and logit models; time series models; and models involving endogenous variables.

This book describes the new generation of discrete choice methods, focusing on the many advances that are made possible by simulation. Researchers use these statistical methods to examine the choices that consumers, households, firms, and other agents make. Each of the major models is covered: logit, generalized extreme value, or GEV (including nested and cross-nested logits), probit, and mixed logit, plus a variety of specifications that build on these basics. Simulation-assisted estimation procedures are investigated and compared, including maximum stimulated likelihood, method of simulated moments, and method of simulated scores. Procedures for drawing from densities are described, including variance reduction techniques such as anithetics and Halton draws. Recent advances in Bayesian procedures are explored, including the use of the Metropolis-Hastings algorithm and its variant Gibbs sampling. The second edition adds chapters on endogeneity and expectation-maximization (EM) algorithms. No other book incorporates all these fields, which have arisen in the past 25 years. The procedures are applicable in many fields, including energy, transportation, environmental studies, health, labor, and marketing.

The purpose of this book is to introduce Bayesian modeling by the use of computation using R language. R provides a wide range of functions for data manipulation, calculation, and graphical displays.

This textbook explains the basic ideas of subjective probability and shows how subjective probabilities must obey the usual rules of probability to ensure coherency. It defines the likelihood function, prior distributions and posterior distributions. It explains how posterior distributions are the basis for inference and explores their basic properties. Various methods of specifying prior distributions are considered, with special emphasis on subject-matter considerations and exchange ability. The regression model is examined to show how analytical methods may fail in the derivation of marginal posterior distributions. The remainder of the book is concerned with applications of the theory to important models that are used in economics, political science, biostatistics and other applied fields. New to the second edition is a chapter on semiparametric regression and new sections on the ordinal probit, item response, factor analysis, ARCH-GARCH and stochastic volatility models. The new edition also emphasizes the R programming language.

R is a language and environment for data analysis and graphics. It may be considered an implementation of S, an award-winning language initially developed at Bell Laboratories since the late 1970s. The R project was initiated by Robert Gentleman and Ross Ihaka at the University of Auckland, New Zealand, in the early 1990s, and has been developed by an international team since mid-1997. Historically, econometricians have favored other computing environments, some of which have fallen by the wayside, and also a variety of packages with canned routines. We believe that R has great potential in econometrics, both for research and for teaching. There are at least three reasons for this: (1) R is mostly platform independent and runs on Microsoft Windows, the Mac family of operating systems, and various flavors of Unix/Linux, and also on some more exotic platforms. (2) R is free software that can be downloaded and installed at no cost from a family of mirror sites around the globe, the Comprehensive R Archive Network (CRAN); hence students can easily install it on their own machines. (3) R is open-source software, so that the full source code is available and can be inspected to understand what it really does, learn from it, and modify and extend it. We also like to think that platform independence and the open-source philosophy make R an ideal environment for reproducible econometric research.

Table of contents

This is an introduction to Bayesian statistics and decision theory, including advanced topics such as Monte Carlo methods. This new edition contains several revised
Although interest in spatial regression models has surged in recent years, a comprehensive, up-to-date text on these approaches does not exist. Filling this void, Introduction to Spatial Econometrics presents a variety of regression methods used to analyze spatial data samples that violate the traditional assumption of independence between observations. It explores a wide range of alternative topics, including maximum likelihood and Bayesian estimation, various types of spatial regression specifications, and applied modeling situations involving different circumstances. Leaders in this field, the authors clarify the often-mystifying phenomenon of simultaneous spatial dependence. By presenting new methods, they help with the interpretation of spatial regression models, especially ones that include spatial lags of the dependent variable. The authors also examine the relationship between spatiotemporal processes and long-run equilibrium states that are characterized by simultaneous spatial dependence. MATLAB® toolboxes useful for spatial econometric estimation are available on the authors’ websites. This work covers spatial econometric modeling as well as numerous applied illustrations of the methods. It encompasses many recent advances in spatial econometric models—including some previously unpublished results.

This volume in the Econometric Exercises series contains questions and answers to provide students with useful practice, as they attempt to master Bayesian econometrics. In addition to many theoretical exercises, this book contains exercises designed to develop the computational tools used in modern Bayesian econometrics. The latter half of the book contains exercises that show how these theoretical and computational skills are combined in practice, to carry out Bayesian inference in a wide variety of models commonly used by econometricians. Aimed primarily at advanced undergraduate and graduate students studying econometrics, this book may also be useful for students studying finance, marketing, agricultural economics, business economics or, more generally, any field which uses statistics. The book also comes equipped with a supporting website containing all the relevant data sets and MATLAB computer programs for solving the computational exercises.

This textbook on statistical modeling and statistical inference will assist advanced undergraduate and graduate students. Statistical Modeling and Computation provides a unique introduction to modern Statistics from both classical and Bayesian perspectives. It also offers an integrated treatment of Mathematical Statistics and modern statistical computation, emphasizing statistical modeling, computational techniques, and applications. Each of the three parts will cover topics essential to university courses. Part I covers the fundamentals of probability theory. In Part II, the authors introduce a wide variety of classical models that include, among others, linear regression and ANOVA models. In Part III, the authors address the statistical analysis and computation of various advanced models, such as generalized linear, state-space and Gaussian models. Particular attention is paid to fast Monte Carlo techniques for Bayesian inference on these models. Throughout the book the authors include a large number of illustrative examples and solved problems. The book also features a section with solutions, an appendix that serves as a MATLAB primer, and a mathematical supplement.

Methodologies for analyzing the forces that move and shape national economies have advanced markedly in the last thirty years, enabling economists as never before to unite theoretical and empirical research and align measurement with theory. In Structural Macroeconometrics, David DeJong and Chetan Dave provide the unified overview and in-depth treatment analysts need to apply these latest theoretical models and empirical techniques. The authors’ emphasis throughout is on time series econometrics. DeJong and Dave detail methods available for solving dynamic structural models and casting solutions in the form of statistical models with empirical implications that may be analyzed either analytically or numerically. They present the full range of methodologies for characterizing and evaluating these empirical implications, including calibration exercises, method-of-moment procedures, and likelihood-based procedures, both classical and Bayesian. The book is complete with a rich array of implementation algorithms, sample empirical applications, and supporting computer code. Structural Macroeconometrics is tailored specifically to equip readers with a set of practical tools that can be used to expedite their entry into the field. DeJong and Dave’s uniquely accessible, how-to approach makes this the ideal textbook for graduate students seeking an introduction to macroeconomics and econometrics and for advanced students pursuing applied research in macroeconomics. The book’s historical perspective, along with its broad presentation of alternative methodologies, makes it an indispensable resource for academics and professionals.

Now in its third edition, this classic book is widely considered the leading text on Bayesian methods, lauded for its accessible, practical approach to analyzing data and solving research problems. Bayesian Data Analysis, Third Edition continues to take an applied approach to analysis using up-to-date Bayesian methods. The authors—all leaders in the statistics community—introduce basic concepts from a data-analytic perspective before presenting advanced methods. Throughout the text, numerous worked examples drawn from real applications and research emphasize the use of Bayesian inference in practice. New to the Third Edition Four new
chapters on nonparametric modeling Coverage of weakly informative priors and boundary-avoiding priors Updated discussion of cross-validation and predictive information criteria Improved convergence monitoring and effective sample size calculations for iterative simulation Presentations of Hamiltonian Monte Carlo, variational Bayes, and expectation propagation New and revised software code The book can be used in three different ways. For undergraduate students, it introduces Bayesian inference starting from first principles. For graduate students, the text presents effective current approaches to Bayesian modeling and computation in statistics and related fields. For researchers, it provides an assortment of Bayesian methods in applied statistics. Additional materials, including data sets used in the examples, solutions to selected exercises, and software instructions, are available on the book’s web page.

Praise for the First Edition "[t]he book is great for readers who need to apply the methods and models presented but have little background in mathematics and statistics." -MAA Reviews Thoroughly updated throughout, Introduction to Time Series Analysis and Forecasting, Second Edition presents the underlying theories of time series analysis that are needed to analyze time-oriented data and construct real-world short- to medium-term statistical forecasts. Authored by highly-experienced academics and professionals in engineering statistics, the Second Edition features discussions on both popular and modern time series methodologies as well as an introduction to Bayesian methods in forecasting. Introduction to Time Series Analysis and Forecasting, Second Edition also includes: Over 300 exercises from diverse disciplines including health care, environmental studies, engineering, and finance More than 50 programming algorithms using JMP®, SAS®, and R that illustrate the theory and practicality of forecasting techniques in the context of time-oriented data New material on frequency domain and spatial temporal data analysis Expanded coverage of the variogram and spectrum with applications as well as transfer and intervention model functions A supplementary website featuring PowerPoint® slides, data sets, and select solutions to the problems Introduction to Time Series Analysis and Forecasting, Second Edition is an ideal textbook upper-undergraduate and graduate-levels courses in forecasting and time series. The book is also an excellent reference for practitioners and researchers who need to model and analyze time series data to generate forecasts.

A unified Bayesian treatment of the state-of-the-art filtering, smoothing, and parameter estimation algorithms for non-linear state space models.

Among the many uses of hierarchical modeling, their application to the statistical analysis of spatial and spatio-temporal data from areas such as epidemiology And environmental science has proven particularly fruitful. Yet to date, the few books that address the subject have been either too narrowly focused on specific aspects of spatial analysis,

This is the perfect (and essential) supplement for all econometrics classes--from a rigorous first undergraduate course, to a first master's, to a PhD course. Explains what is going on in textbooks full of proofs and formulas Offers intuition, skepticism, insights, humor, and practical advice (dos and don'ts) Contains new chapters that cover instrumental variables and computational considerations Includes additional information on GMM, nonparametrics, and an introduction to wavelets

A practical approach to using regression and computation to solve real-world problems of estimation, prediction, and causal inference.

This second edition of Hilbe's Negative Binomial Regression is a substantial enhancement to the popular first edition. The only text devoted entirely to the negative binomial model and its many variations, nearly every model discussed in the literature is addressed. The theoretical and distributional background of each model is discussed, together with examples of their construction, application, interpretation and evaluation. Complete Stata and R codes are provided throughout the text, with additional code (plus SAS), derivations and data provided on the book's website. Written for the practising researcher, the text begins with an examination of risk and rate ratios, and of the estimating algorithms used to model count data. The book then gives an in-depth analysis of Poisson regression and an evaluation of the meaning and nature of overdispersion, followed by a comprehensive analysis of the negative binomial distribution and of its parameterizations into various models for evaluating count data.

Beyond the introductory level, learning and effectively using statistical methods in the social sciences requires some knowledge of mathematics. This handy volume introduces the areas of mathematics that are most important to applied social statistics.

In this richly illustrated book, a range of accessible examples are used to show how Bayes' rule is actually a natural consequence of commonsense reasoning. The tutorial style of writing, combined with a comprehensive glossary, makes this an ideal primer for the novice who wishes to become familiar with the basic principles of Bayesian analysis.
Introduces the increasingly popular Bayesian approach to statistics to graduates and advanced undergraduates. In contrast to the long-standing frequentist approach to statistics, the Bayesian approach makes explicit use of prior information and is based on the subjective view of probability. Bayesian econometrics takes probability theory as applying to all situations in which uncertainty exists, including uncertainty over the values of parameters. A distinguishing feature of this book is its emphasis on classical and Markov chain Monte Carlo (MCMC) methods of simulation. The book is concerned with applications of the theory to important models that are used in economics, political science, biostatistics, and other applied fields. These include the linear regression model and extensions to Tobit, probit, and logit models; time series models; and models involving endogenous variables.

This Bayesian modeling book provides a self-contained entry to computational Bayesian statistics. Focusing on the most standard statistical models and backed up by real datasets and an all-inclusive R (CRAN) package called bayess, the book provides an operational methodology for conducting Bayesian inference, rather than focusing on its theoretical and philosophical justifications. Readers are empowered to participate in the real-life data analysis situations depicted here from the beginning. Special attention is paid to the derivation of prior distributions in each case and specific reference solutions are given for each of the models. Similarly, computational details are worked out to lead the reader towards an effective programming of the methods given in the book. In particular, all R codes are discussed with enough detail to make them readily understandable and expandable. Bayesian Essentials with R can be used as a textbook at both undergraduate and graduate levels. It is particularly useful with students in professional degree programs and scientists to analyze data the Bayesian way. The text will also enhance introductory courses on Bayesian statistics. Prerequisites for the book are an undergraduate background in probability and statistics, if not in Bayesian statistics.

Tools to improve decision making in an imperfect world This publication provides readers with a thorough understanding of Bayesian analysis that is grounded in the theory of inference and optimal decision making. Contemporary Bayesian Econometrics and Statistics provides readers with state-of-the-art simulation methods and models that are used to solve complex real-world problems. Armed with a strong foundation in both theory and practical problem-solving tools, readers discover how to optimize decision making when faced with problems that involve limited or imperfect data. The book begins by examining the theoretical and mathematical foundations of Bayesian statistics to help readers understand how and why it is used in problem solving. The author then describes how modern simulation methods make Bayesian approaches practical by using widely available mathematical applications software. In addition, the author details how models can be applied to specific problems, including: * Linear models and policy choices * Modeling with latent variables and missing data * Time series models and prediction * Comparison and evaluation of models The publication has been developed and fine-tuned through a decade of classroom experience, and readers will find the author's approach very engaging and accessible. There are nearly 200 examples and exercises to help readers see how effective use of Bayesian statistics enables them to make optimal decisions. MATLAB® and R computer programs are integrated throughout the book. An accompanying Web site provides readers with computer code for many examples and datasets. This publication is tailored for research professionals who use econometrics and similar statistical methods in their work. With its emphasis on practical problem solving and extensive use of examples and exercises, this is also an excellent textbook for graduate-level students in a broad range of fields, including economics, statistics, the social sciences, business, and public policy.

Essential Statistics, Regression, and Econometrics, Second Edition, is innovative in its focus on preparing students for regression/econometrics, and in its extended emphasis on statistical reasoning, real data, pitfalls in data analysis, and modeling issues. This book is uncommonly approachable and easy to use, with extensive word problems that emphasize intuition and understanding. Too many students mistakenly believe that statistics courses are too abstract, mathematical, and tedious to be useful or interesting. To demonstrate the power, elegance, and even beauty of statistical reasoning, this book provides hundreds of new and updated interesting and relevant examples, and discusses not only the uses but also the abuses of statistics. The examples are drawn from many areas to show that statistical reasoning is not an irrelevant abstraction, but an important part of everyday life. Includes hundreds of updated and new, real-world examples to engage students in the meaning and impact of statistics. Focuses on essential information to enable students to develop their own statistical reasoning. Ideal for one-quarter or one-semester courses taught in economics, business, finance, politics, sociology, and psychology departments, as well as in law and medical schools. Accompanied by an ancillary website with an instructors solutions manual, student solutions manual and supplementing chapters.

Praise for the First Edition "I cannot think of a better book for teachers of introductory statistics who want a readable and pedagogically sound text to introduce Bayesian statistics." —Statistics in Medical Research "[This book] is written in a lucid conversational style, which is so rare in mathematical writings. It does an excellent job of presenting Bayesian statistics as a perfectly reasonable approach to elementary problems in statistics." —STATS: The Magazine for Students of
Master Bayesian Inference through Practical Examples and Computation—Without Advanced Mathematical Analysis Bayesian methods of inference are deeply natural and extremely powerful. However, most discussions of Bayesian inference rely on intensely complex mathematical analyses and artificial examples, making it inaccessible to anyone without a strong mathematical background. Now, though, Cameron Davidson-Pilon introduces Bayesian inference from a computational and extremely powerful. However, most discussions of Bayesian inference rely on intensely complex mathematical analyses and artificial examples, making it inaccessible to anyone without a strong mathematical background. Now, though, Cameron Davidson-Pilon introduces Bayesian inference from a computational perspective allows for direct probability statements about parameters, and this approach is now more relevant than ever due to computer programs that allow practitioners to work on problems that contain many parameters. This book uniquely covers the topics typically found in an introductory statistics book—but from a Bayesian perspective—giving readers an advantage as they enter fields where statistics is used. This Second Edition provides: Extended coverage of Poisson and Gamma distributions Two new chapters on Bayesian inference for Poisson observations and Bayesian inference for the standard deviation for normal observations A twenty-five percent increase in exercises with selected answers at the end of the book A calculus refresher appendix and a summary on the use of statistical tables New computer exercises that use R functions and Minitab® macros for Bayesian analysis and Monte Carlo simulations Introduction to Bayesian Statistics, Second Edition is an invaluable textbook for advanced undergraduate and graduate-level statistics courses as well as a practical reference for statisticians who require a working knowledge of Bayesian statistics.

"this edition is useful and effective in teaching Bayesian inference at both elementary and intermediate levels. It is a well-written book on elementary Bayesian inference, and the material is easily accessible. It is both concise and timely, and provides a good collection of overviews and reviews of important tools used in Bayesian statistical methods." There is a strong upsurge in the use of Bayesian methods in applied statistical analysis, yet most introductory statistics texts only present frequentist methods. Bayesian statistics has many important advantages that students should learn about if they are going into fields where statistics will be used. In this third Edition, four newly-added chapters address topics that reflect the rapid advances in the field of Bayesian statistics. The authors continue to provide a Bayesian treatment of introductory statistical topics, such as scientific data gathering, discrete random variables, robust Bayesian methods, and Bayesian approaches to inference for discrete random variables, binomial proportions, Poisson, and normal means, and simple linear regression. In addition, more advanced topics in the field are presented in four new chapters: Bayesian inference for a normal with unknown mean and variance; Bayesian inference for a Multivariate Normal mean vector; Bayesian inference for the Multiple Linear Regression Model; and Computational Bayesian Statistics including Markov Chain Monte Carlo. The inclusion of these topics will facilitate readers' ability to advance from a minimal understanding of Statistics to the ability to tackle topics in more applied, advanced level books. Minitab macros and R functions are available on the book's related website to assist with chapter exercises. Introduction to Bayesian Statistics, Third Edition also features: Topics including the Joint Likelihood function and inference using independent Jeffreys priors and join conjugate prior The cutting-edge topic of computational Bayesian Statistics in a new chapter, with a unique focus on Markov Chain Monte Carlo methods Exercises throughout the book that have been updated to reflect new applications and the latest software applications. Detailed appendices that guide readers through the use of R and Minitab software for Bayesian analysis and Monte Carlo simulations, with all related macros available on the book's website. Introduction to Bayesian Statistics, Third Edition is a textbook for upper-undergraduate or first-year graduate level courses on introductory statistics course with a Bayesian emphasis. It can also be used as a reference work for statisticians who require a working knowledge of Bayesian statistics.

The high-level language of R is recognized as one of the most powerful and flexible statistical software environments, and is rapidly becoming the standard setting for quantitative analysis, statistics and graphics. R provides free access to unrivalled coverage and cutting-edge applications, enabling the user to apply numerous statistical methods ranging from simple regression to time series or multivariate analysis. Building on the success of the author’s bestselling Statistics: An Introduction using R, The R Book is packed with worked examples, providing an all inclusive guide to R, ideal for novice and more accomplished users alike. The book assumes no background in statistics or computing and introduces the advantages of the R environment, detailing its applications in a wide range of disciplines. Provides the first comprehensive reference manual for the R language, including practical guidance and full coverage of the graphics facilities. Introduces all the statistical models covered by R, beginning with simple classical tests such as chi-square and t-test. Proceeds to examine more advance methods, from regression and analysis of variance, through to generalized linear models, generalized mixed models, time series, spatial statistics, multivariate statistics and much more. The R Book is aimed at undergraduates, postgraduates and professionals in science, engineering and medicine. It is also ideal for students and professionals in statistics, economics, geography and the social sciences.

Master Bayesian Inference through Practical Examples and Computation—Without Advanced Mathematical Analysis Bayesian methods of inference are deeply natural and extremely powerful. However, most discussions of Bayesian inference rely on intensely complex mathematical analyses and artificial examples, making it inaccessible to anyone without a strong mathematical background. Now, though, Cameron Davidson-Pilon introduces Bayesian inference from a computational
perspective, bridging theory to practice—freeing you to get results using computing power. Bayesian Methods for Hackers illuminates Bayesian inference through probabilistic programming with the powerful PyMC language and the closely related Python tools NumPy, SciPy, and Matplotlib. Using this approach, you can reach effective solutions in small increments, without extensive mathematical intervention. Davidson-Pilon begins by introducing the concepts underlying Bayesian inference, comparing it with other techniques and guiding you through building and training your first Bayesian model. Next, he introduces PyMC through a series of detailed examples and intuitive explanations that have been refined after extensive user feedback. You’ll learn how to use the Markov Chain Monte Carlo algorithm, choose appropriate sample sizes and priors, work with loss functions, and apply Bayesian inference in domains ranging from finance to marketing. Once you’ve mastered these techniques, you’ll constantly turn to this guide for the working PyMC code you need to jumpstart future projects. Coverage includes • Learning the Bayesian “state of mind” and its practical implications • Understanding how computers perform Bayesian inference • Using the PyMC Python library to program Bayesian analyses • Building and debugging models with PyMC • Testing your model’s “goodness of fit” • Opening the “black box” of the Markov Chain Monte Carlo algorithm to see how and why it works • Leveraging the power of the “Law of Large Numbers” • Mastering key concepts, such as clustering, convergence, autocorrelation, and thinning • Using loss functions to measure an estimate’s weaknesses based on your goals and desired outcomes • Selecting appropriate priors and understanding how their influence changes with dataset size • Overcoming the “exploration versus exploitation” dilemma: deciding when “pretty good” is good enough • Using Bayesian inference to improve A/B testing • Solving data science problems when only small amounts of data are available Cameron Davidson-Pilon has worked in many areas of applied mathematics, from the evolutionary dynamics of genes and diseases to stochastic modeling of financial prices. His contributions to the open source community include lifelines, an implementation of survival analysis in Python. Educated at the University of Waterloo and at the Independent University of Moscow, he currently works with the online commerce leader Shopify.

Statistical science’s first coordinated manual of methods for analyzing ordered categorical data, now fully revised and updated, continues to present applications and case studies in fields as diverse as sociology, public health, ecology, marketing, and pharmacy. Analysis of Ordinal Categorical Data, Second Edition provides an introduction to basic descriptive and inferential methods for categorical data, giving thorough coverage of new developments and recent methods. Special emphasis is placed on interpretation and application of methods including an integrated comparison of the available strategies for analyzing ordinal data. Practitioners of statistics in government, industry (particularly pharmaceutical), and academia will want this new edition.

This book provides the most comprehensive and up-to-date account of regression methods to explain the frequency of events.

The essential introduction to the theory and application of linear models—now in a valuable new edition Since most advanced statistical tools are generalizations of the linear model, it is necessary to first master the linear model in order to move forward to more advanced concepts. The linear model remains the main tool of the applied statistician and is central to the training of any statistician regardless of whether the focus is applied or theoretical. This completely revised and updated new edition successfully develops the basic theory of linear models for regression, analysis of variance, analysis of covariance, and linear mixed models. Recent advances in the methodology related to linear mixed models, generalized linear models, and the Bayesian linear model are also addressed. Linear Models in Statistics, Second Edition includes full coverage of advanced topics, such as mixed and generalized linear models, Bayesian linear models, two-way models with empty cells, geometry of least squares, vector-matrix calculus, simultaneous inference, and logistic and nonlinear regression. Algebraic, geometrical, frequentist, and Bayesian approaches to both the inference of linear models and the analysis of variance are also illustrated. Through the expansion of relevant material and the inclusion of the latest technological developments in the field, this book provides readers with the theoretical foundation to correctly interpret computer software output as well as effectively use, customize, and understand linear models. This modern Second Edition features: New chapters on Bayesian linear models as well as random and mixed linear models Expanded discussion of two-way models with empty cells Additional sections on the geometry of least squares Updated coverage of simultaneous inference The book is complemented with easy-to-read proofs, real data sets, and an extensive bibliography. A thorough review of the requisite matrix algebra has been added for transitional purposes, and numerous theoretical and applied problems have been incorporated with selected answers provided at the end of the book. A related Web site includes additional data sets and SAS® code for all numerical examples. Linear Model in Statistics, Second Edition is a must-have book for courses in statistics, biostatistics, and mathematics at the upper-undergraduate and graduate levels. It is also an invaluable reference for researchers who need to gain a better understanding of regression and analysis of variance.

Dynamic stochastic general equilibrium (DSGE) models have become one of the workhorses of modern macroeconomics and are extensively used for academic research as well as forecasting and policy analysis at central banks. This book introduces readers to state-of-the-art computational techniques used in the Bayesian analysis of DSGE models. The book covers Markov chain Monte Carlo techniques for linearized DSGE models, novel sequential Monte Carlo methods that can be used
for parameter inference, and the estimation of nonlinear DSGE models based on particle filter approximations of the likelihood function. The theoretical foundations of the algorithms are discussed in depth, and detailed empirical applications and numerical illustrations are provided. The book also gives invaluable advice on how to tailor these algorithms to specific applications and assess the accuracy and reliability of the computations. Bayesian Estimation of DSGE Models is essential reading for graduate students, academic researchers, and practitioners at policy institutions.

Written by one of the preeminent researchers in the field, this book provides a comprehensive exposition of modern analysis of causation. It shows how causality has grown from a nebulous concept into a mathematical theory with significant applications in the fields of statistics, artificial intelligence, economics, philosophy, cognitive science, and the health and social sciences. Judea Pearl presents and unifies the probabilistic, manipulative, counterfactual, and structural approaches to causation and devises simple mathematical tools for studying the relationships between causal connections and statistical associations. Cited in more than 2,100 scientific publications, it continues to liberate scientists from the traditional molds of statistical thinking. In this revised edition, Judea Pearl elucidates thorny issues, answers readers' questions, and offers a panoramic view of recent advances in this field of research. Causality will be of interest to students and professionals in a wide variety of fields. Dr Judea Pearl has received the 2011 Rumelhart Prize for his leading research in Artificial Intelligence (AI) and systems from The Cognitive Science Society.

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