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Mixture models have been around for over 150 years, and they are found in many branches of statistical modelling, as a versatile and multifaceted tool. They can be applied to a wide range of data: univariate or multivariate, continuous or categorical, cross-sectional, time series, networks, and much more. Mixture analysis is a very active research topic in statistics and machine learning, with new developments in methodology and applications taking place all the time. The Handbook of Mixture Analysis is a very timely publication, presenting a broad overview of the methods and applications of this important field of research. It covers a wide array of topics, including the EM algorithm, Bayesian mixture models, model-based clustering, high-dimensional data, hidden Markov models, and applications in finance, genomics, and astronomy. Features: Provides a comprehensive overview of the methods and applications of mixture modelling and analysis Divided into three parts: Foundations and Methods; Mixture Modelling and Extensions; and Selected Applications Contains many worked examples using real data, together with computational implementation, to illustrate the methods described Includes contributions from the leading researchers in the field The Handbook of Mixture Analysis is targeted at graduate students and young researchers new to the field. It will also be an important reference for anyone working in this field, whether they are developing new methodology, or applying the models to real scientific problems.

Justice will be swirled by amateur sleuth Riley Rhodes in the first in Meri Allen's brand-new mystery series, The Rocky Road to Ruin! Riley Rhodes, travel food blogger and librarian at the CIA, makes a bittersweet return to her childhood home of Penniman, Connecticut – land of

dairy farms and covered bridges - for a funeral. Despite the circumstances, Riley's trip home is sprinkled with reunions with old friends, visits to her father's cozy bookshop on the town green, and joyful hours behind the counter at the beloved Udderly Delicious Ice Cream Shop. It feels like a time to help her friend Caroline rebuild after her mother's death, and for Riley to do a bit of her own reflecting after a botched undercover mission in Italy. After all, it's always good to be home. But Caroline and her brother Mike have to decide what to do with the assets they've inherited – the ice cream shop as well as the farm they grew up on – and they've never seen eye to eye. Trouble begins to swirl as Riley is spooked by reports of a stranger camping behind the farm and by the odd behavior of the shop's mascot, Caroline's snooty Persian, Sprinkles. When Mike turns up dead in the barn the morning after the funeral, the peace and quiet of Penniman seems upended for good. Can Riley find the killer before another body gets scooped?

The statistics profession is at a unique point in history. The need for valid statistical tools is greater than ever; data sets are massive, often measuring hundreds of thousands of measurements for a single subject. The field is ready to move towards clear objective benchmarks under which tools can be evaluated. Targeted learning allows (1) the full generalization and utilization of cross-validation as an estimator selection tool so that the subjective choices made by humans are now made by the machine, and (2) targeting the fitting of the probability distribution of the data toward the target parameter representing the scientific question of interest. This book is aimed at both statisticians and applied researchers interested in causal inference and general effect estimation for observational and experimental data. Part I is an accessible introduction to super learning and the targeted maximum likelihood

estimator, including related concepts necessary to understand and apply these methods. Parts II-IX handle complex data structures and topics applied researchers will immediately recognize from their own research, including time-to-event outcomes, direct and indirect effects, positivity violations, case-control studies, censored data, longitudinal data, and genomic studies.

You will have many times in your life when you need to hang on, but occasionally you will need to buckle up and strap in for the ride. That is no lie. This is the story of my life as a normal (okay, semi-normal) working mom raising a family and then bam! I was hit with major health issues-major as in the Mayo Clinic kind of things. This is the account and play-by-play (I was a coach) of how life can become seriously something you never envisioned and how things happen that you would not wish on your worst enemy. How I was able to do things that I never figured I would have the courage and strength to get through. How God equipped me to face these trials by keeping my head up and walking the walk. You will be able to see the change from a fairly strong woman to someone who now feels she can face anything head-on and not feel the need to drive herself off a cliff. There have been life-changing tests that seemed terrible and overwhelming, but they were things that I now see needed to happen. I saw firsthand that there are angels on earth. We are given people to help us share our journeys with, make each other better. Life is more fun together, and that is how we can live a great story. But most importantly, breathe.

This book assembles papers which were presented at the biennial sympo sium in Computational Statistics held und er the a!uspices of the International Association for Statistical Computing (IASC), a section of ISI, the Interna tional Statistical Institute. This symposium named COMPSTAT '94 was organized by the Statistical Institutes of the University

of Vienna and the University of Technology of Vienna, Austria. The series of COMPSTAT Symposia started 1974 in Vienna. Mean while they took place every other year in Berlin (Germany, 1976), Leiden (The Netherlands, 1978), Edinburgh (Great Britain, 1980), Toulouse (France, 1982), Prague (Czechoslovakia, 1984), Rom (Italy, 1986), Copenhagen (Den mark, 1988), Dubrovnik (Yugoslavia, 1990) and Neuchâtel (Switzerland, 1992). This year we are celebrating the 20th anniversary in Vienna, Austria. It has obviously been observed a movement from "traditional" computa tional statistics with emphasis on methods which produce results quickly and reliably, to computationally intensive methods like resampling procedures, Bayesian methods, dynamic graphics, to very recent areas like neural net works, accentuation on spatial statistics, huge data sets, analysis strategies, etc. For the organization of the symposium, new guidelines worked out by the IASC in written form were in effect this time. The goal was to refresh somehow the spirit of the start of COMPSTAT '74, keep the tradition of the series and ensure a certain continuity in the sequence of biannual meetings.

This text presents statistical methods for studying causal effects and discusses how readers can assess such effects in simple randomized experiments.

This book reviews the state-of-the-art advances in skew-elliptical distributions and provides many new developments in a single volume, collecting theoretical results and applications previously scattered throughout the literature. The main goal of this research area is to develop flexible parametric classes of distributions beyond the classical no

Chronic conditions and diseases are the leading cause of mortality and morbidity in Europe, accounting for 86% of total premature deaths, and research suggests

that complex conditions such as diabetes and depression will impose an even greater health burden in the future - and not only for the rich and elderly in high-income countries, but increasingly for the poor as well as low- and middle-income countries. The epidemiologic and economic analyses in the first part of the book suggest that policy-makers should make chronic disease a priority. This book highlights the issues and focuses on the strategies and interventions that policy-makers have at their disposal to tackle this increasing challenge. Strategic discussed in the second part of this volume include (1) prevention and early detection, (2) new provider qualifications (e.g. nurse practitioners) and settings, (3) disease management programmes and (4) integrated care models. But choosing the right strategies will be difficult, particularly given the limited evidence on effectiveness and cost-effectiveness. In the third part, the book therefore outlines and discusses institutional and organizational challenges for policy-makers and managers: (1) stimulating the development of new effective pharmaceuticals and medical devices, (2) designing appropriate financial incentives, (3) improving coordination, (4) using information and communication technology, and (5) ensuring evaluation. To tackle these challenges successfully, key policy recommendations are made.

Deep reinforcement learning (DRL) is the combination of reinforcement learning

(RL) and deep learning. It has been able to solve a wide range of complex decision-making tasks that were previously out of reach for a machine, and famously contributed to the success of AlphaGo. Furthermore, it opens up numerous new applications in domains such as healthcare, robotics, smart grids and finance. Divided into three main parts, this book provides a comprehensive and self-contained introduction to DRL. The first part introduces the foundations of deep learning, reinforcement learning (RL) and widely used deep RL methods and discusses their implementation. The second part covers selected DRL research topics, which are useful for those wanting to specialize in DRL research. To help readers gain a deep understanding of DRL and quickly apply the techniques in practice, the third part presents mass applications, such as the intelligent transportation system and learning to run, with detailed explanations. The book is intended for computer science students, both undergraduate and postgraduate, who would like to learn DRL from scratch, practice its implementation, and explore the research topics. It also appeals to engineers and practitioners who do not have strong machine learning background, but want to quickly understand how DRL works and use the techniques in their applications. What constitutes a causal explanation, and must an explanation be causal? What warrants a causal inference, as opposed to a descriptive regularity? What

techniques are available to detect when causal effects are present, and when can these techniques be used to identify the relative importance of these effects? What complications do the interactions of individuals create for these techniques? When can mixed methods of analysis be used to deepen causal accounts? Must causal claims include generative mechanisms, and how effective are empirical methods designed to discover them? The Handbook of Causal Analysis for Social Research tackles these questions with nineteen chapters from leading scholars in sociology, statistics, public health, computer science, and human development.

This book is intended for anyone, regardless of discipline, who is interested in the use of statistical methods to help obtain scientific explanations or to predict the outcomes of actions, experiments or policies. Much of G. Udny Yule's work illustrates a vision of statistics whose goal is to investigate when and how causal influences may be reliably inferred, and their comparative strengths estimated, from statistical samples. Yule's enterprise has been largely replaced by Ronald Fisher's conception, in which there is a fundamental cleavage between experimental and non experimental inquiry, and statistics is largely unable to aid in causal inference without randomized experimental trials. Every now and then members of the statistical community express misgivings about this turn of

events, and, in our view, rightly so. Our work represents a return to something like Yule's conception of the enterprise of theoretical statistics and its potential practical benefits. If intellectual history in the 20th century had gone otherwise, there might have been a discipline to which our work belongs. As it happens, there is not. We develop material that belongs to statistics, to computer science, and to philosophy; the combination may not be entirely satisfactory for specialists in any of these subjects. We hope it is nonetheless satisfactory for its purpose.
The New York Times bestselling series is back, as Katie Bonner—owner of Artisans Alley in the quaint shopping district of Victoria Square—attempts to solve a murder at a nearby B & B. Katie Bonner feels like nothing can spoil her perfect day off, sailing Lake Ontario with her good friend and lawyer Seth Landers. Then she runs into her ex-boss Josh on the dock. It was never smooth sailing with Josh, and Katie is only too happy to get away from him as he makes a scene. Unfortunately, the next day her unpleasant former employer is found drowned in a bathtub at a bed-and-breakfast in Victoria Square. Who would pull the plug on Josh? When an autopsy reveals lake water—not bath water—in his lungs, Katie quickly finds herself in over her head. She'll need to race to find the killer before her business and her freedom both go down the drain…
This book constitutes the refereed proceedings of the Second International

Symposium on Benchmarking, Measuring, and Optimization, Bench 2019, held in Denver, CO, USA, in November 2019. The 20 full papers and 11 short papers presented were carefully reviewed and selected from 79 submissions. The papers are organized in topical sections named: Best Paper Session; AI Challenges on Cambircon using AIBenc; AI Challenges on RISC-V using AIBench; AI Challenges on X86 using AIBench; AI Challenges on 3D Face Recognition using AIBench; Benchmark; AI and Edge; Big Data; Datacenter; Performance Analysis; Scientific Computing.

The application of causal inference methods is growing exponentially in fields that deal with observational data. Written by pioneers in the field, this practical book presents an authoritative yet accessible overview of the methods and applications of causal inference. With a wide range of detailed, worked examples using real epidemiologic data as well as software for replicating the analyses, the text provides a thorough introduction to the basics of the theory for non-time-varying treatments and the generalization to complex longitudinal data.

'One of the most important books I've read in years' Brian Eno We are losing the commons. Austerity and neoliberal policies have depleted our shared wealth; our national utilities have been sold off to foreign conglomerates, social housing is almost non-existent, our parks are cordoned off for private events and our national art galleries are sponsored by banks and oil

companies. This plunder deprives us all of our common rights, recognized as far back as the Magna Carta and the Charter of the Forest of 1217, to share fairly and equitably in our public wealth. Guy Standing leads us through a new appraisal of the commons, stemming from the medieval concept of common land reserved in ancient law from marauding barons, to his modern reappraisal of the resources we all hold in common - a brilliant new synthesis that crystallises quite how much public wealth has been redirected to the 1% in recent decades through the state-approved exploitation of everything from our land to our state housing, health and benefit systems, to our justice system, schools, newspapers and even the air we breathe. Plunder of the Commons proposes a charter for a new form of commoning, of remembering, guarding and sharing that which belongs to us all, to slash inequality and soothe our current political instability.

'Applied Econometrics' takes an intuitive, hands-on approach to presenting modern econometrics. Wide-ranging yet compact, the book features extensive software integration and contains empirical applications throughout. It provides step-by-step guidelines for all econometric tests and methods of estimation, and also provides interpretations of the results. The second edition of this popular book features expanded topical coverage, more coverage of fundamental concepts for students new to the subject or requiring a 'refresher', integrated finance applications throughout, as well as the addition of Stata to the software coverage (already featuring EViews and Microfit). New chapters include: ? Limited Dependent Variable Regression Models ? Identification in Standard and Cointegrated Systems ? Solving Models This is an ideal book for undergraduate and master's economics or finance students taking a first course in applied econometrics. A companion website for this book is available at

www.palgrave.com/economics/asteriou2 which contains: ? data files for students ? PowerPoint slides for lecturers

This book presents a simple geometric model of voting as a tool to analyze parliamentary roll call data. Each legislator is represented by one point and each roll call is represented by two points that correspond to the policy consequences of voting Yea or Nay. On every roll call each legislator votes for the closer outcome point, at least probabilistically. These points form a spatial map that summarizes the roll calls. In this sense a spatial map is much like a road map because it visually depicts the political world of a legislature. The closeness of two legislators on the map shows how similar their voting records are, and the distribution of legislators shows what the dimensions are. These maps can be used to study a wide variety of topics including how political parties evolve over time, the existence of sophisticated voting and how an executive influences legislative outcomes.

Survival analysis is a highly active area of research with applications spanning the physical, engineering, biological, and social sciences. In addition to statisticians and biostatisticians, researchers in this area include epidemiologists, reliability engineers, demographers and economists. The economists survival analysis by the name of duration analysis and the analysis of transition data. We attempted to bring together leading researchers, with a common interest in developing methodology in survival analysis, at the NATO Advanced Research Workshop. The research works collected in this volume are based on the presentations at the Workshop. Analysis of survival experiments is complicated by issues of censoring, where only partial observation of an individual's life length is available and left truncation, where individuals enter the study group if their life lengths exceed a given threshold time. Application of the

theory of counting processes to survival analysis, as developed by the Scandinavian School, has allowed for substantial advances in the procedures for analyzing such experiments. The increased use of computer intensive solutions to inference problems in survival analysis~ in both the classical and Bayesian settings, is also evident throughout the volume. Several areas of research have received special attention in the volume.

Hunting Causes and Using Them argues that causation is not one thing, as commonly assumed, but many. There is a huge variety of causal relations, each with different characterizing features, different methods for discovery and different uses to which it can be put. In this collection of new and previously published essays, Nancy Cartwright provides a critical survey of philosophical and economic literature on causality, with a special focus on the currently fashionable Bayes-nets and invariance methods - and it exposes a huge gap in that literature. Almost every account treats either exclusively how to hunt causes or how to use them. But where is the bridge between? It's no good knowing how to warrant a causal claim if we don't know what we can do with that claim once we have it. This book will interest philosophers, economists and social scientists.

Discovering Causal Structure: Artificial Intelligence, Philosophy of Science, and Statistical Modeling provides information pertinent to the fundamental aspects of a computer program called TETRAD. This book discusses the version of the TETRAD program, which is designed to assist in the search for causal explanations of statistical data. or alternative models. This text then examines the notion of applying artificial intelligence methods to problems of statistical model specification. Other chapters consider how the TETRAD program can help to find god alternative models where they exist, and how it can help detect the existence of

important neglected variables. This book discusses as well the procedures for specifying a model or models to account for non-experimental or quasi-experimental data. The final chapter presents a description of the format of input files and a description of each command. This book is a valuable resource for social scientists and researchers.

The Department of Energy's Office of Environmental Management (DOE-EM) is responsible for cleaning up radioactive waste and environmental contamination resulting from five decades of nuclear weapons production and testing. A major focus of this program involves the retrieval, processing, and immobilization of waste into stable, solid waste forms for disposal. Waste Forms Technology and Performance, a report requested by DOE-EM, examines requirements for waste form technology and performance in the cleanup program. The report provides information to DOE-EM to support improvements in methods for processing waste and selecting and fabricating waste forms. Waste Forms Technology and Performance places particular emphasis on processing technologies for high-level radioactive waste, DOE's most expensive and arguably most difficult cleanup challenge. The report's key messages are presented in ten findings and one recommendation.

This book introduces MDS as a psychological model and as a data analysis technique for the applied researcher. It also discusses, in detail, how to use two MDS programs, Proxscal (a module of SPSS) and Smacof (an R-package). The book is unique in its orientation on the applied researcher, whose primary interest is in using MDS as a tool to build substantive theories. This is done by emphasizing practical issues (such as evaluating model fit), by presenting ways

to enforce theoretical expectations on the MDS solution, and by discussing typical mistakes that MDS users tend to make. The primary audience of this book are psychologists, social scientists, and market researchers. No particular background knowledge is required, beyond a basic knowledge of statistics.
Machine learning is currently one of the most rapidly growing areas of research in computer science. In compiling this volume we have brought together contributions from some of the most prestigious researchers in this field. This book covers the three main learning systems; symbolic learning, neural networks and genetic algorithms as well as providing a tutorial on learning casual influences. Each of the nine chapters is self-contained. Both theoreticians and application scientists/engineers in the broad area of artificial intelligence will find this volume valuable. It also provides a useful sourcebook for Postgraduate since it shows the direction of current research.
Expert testimony relying on scientific and other specialized evidence has come under increased scrutiny by the legal system. A trilogy of recent U.S. Supreme Court cases has assigned judges the task of assessing the relevance and reliability of proposed expert testimony. In conjunction with the Federal judiciary, the American Association for the Advancement of Science has initiated a project to provide judges indicating a need with their own expert. This concern with the

proper interpretation of scientific evidence, especially that of a probabilistic nature, has also occurred in England, Australia and in several European countries. Statistical Science in the Courtroom is a collection of articles written by statisticians and legal scholars who have been concerned with problems arising in the use of statistical evidence. A number of articles describe DNA evidence and the difficulties of properly calculating the probability that a random individual's profile would "match" that of the evidence as well as the proper way to intrepret the result. In addition to the technical issues, several authors tell about their experiences in court. A few have become disenchanted with their involvement and describe the events that led them to devote less time to this application. Other articles describe the role of statistical evidence in cases concerning discrimination against minorities, product liability, environmental regulation, the appropriateness and fairness of sentences and how being involved in legal statistics has raised interesting statistical problems requiring further research.

Although many books currently available describe statistical models and methods for analyzing longitudinal data, they do not highlight connections between various research threads in the statistical literature. Responding to this void, Longitudinal Data Analysis provides a clear, comprehensive, and unified overview of state-of-

the-art theory and applications. It also focuses on the assorted challenges that arise in analyzing longitudinal data. After discussing historical aspects, leading researchers explore four broad themes: parametric modeling, nonparametric and semiparametric methods, joint models, and incomplete data. Each of these sections begins with an introductory chapter that provides useful background material and a broad outline to set the stage for subsequent chapters. Rather than focus on a narrowly defined topic, chapters integrate important research discussions from the statistical literature. They seamlessly blend theory with applications and include examples and case studies from various disciplines. Destined to become a landmark publication in the field, this carefully edited collection emphasizes statistical models and methods likely to endure in the future. Whether involved in the development of statistical methodology or the analysis of longitudinal data, readers will gain new perspectives on the field.
This book is the first systematic treatment of Bayesian nonparametric methods and the theory behind them. It will also appeal to statisticians in general. The book is primarily aimed at graduate students and can be used as the text for a graduate course in Bayesian non-parametrics.
Research in Bayesian analysis and statistical decision theory is rapidly expanding and diversifying, making it increasingly more difficult for any single

researcher to stay up to date on all current research frontiers. This book provides a review of current research challenges and opportunities. While the book can not exhaustively cover all current research areas, it does include some exemplary discussion of most research frontiers. Topics include objective Bayesian inference, shrinkage estimation and other decision based estimation, model selection and testing, nonparametric Bayes, the interface of Bayesian and frequentist inference, data mining and machine learning, methods for categorical and spatio-temporal data analysis and posterior simulation methods. Several major application areas are covered: computer models, Bayesian clinical trial design, epidemiology, phylogenetics, bioinformatics, climate modeling and applications in political science, finance and marketing. As a review of current research in Bayesian analysis the book presents a balance between theory and applications. The lack of a clear demarcation between theoretical and applied research is a reflection of the highly interdisciplinary and often applied nature of research in Bayesian statistics. The book is intended as an update for researchers in Bayesian statistics, including non-statisticians who make use of Bayesian inference to address substantive research questions in other fields. It would also be useful for graduate students and research scholars in statistics or biostatistics who wish to acquaint themselves with current research frontiers.

Survival analysis arises in many fields of study including medicine, biology, engineering, public health, epidemiology, and economics. This book provides a comprehensive treatment of Bayesian survival analysis. It presents a balance between theory and applications, and for each class of models discussed, detailed examples and analyses from case studies are presented whenever possible. The applications are all from the health sciences, including cancer, AIDS, and the environment.

Survival Analysis with Interval-Censored Data: A Practical Approach with Examples in R, SAS, and BUGS provides the reader with a practical introduction into the analysis of interval-censored survival times. Although many theoretical developments have appeared in the last fifty years, interval censoring is often ignored in practice. Many are unaware of the impact of inappropriately dealing with interval censoring. In addition, the necessary software is at times difficult to trace. This book fills in the gap between theory and practice. Features: -Provides an overview of frequentist as well as Bayesian methods. -Include a focus on practical aspects and applications. -Extensively illustrates the methods with examples using R, SAS, and BUGS. Full programs are available on a supplementary website. The authors: Kris Bogaerts is project manager at I-BioStat, KU Leuven. He received his PhD in science (statistics) at KU Leuven on the analysis of interval-censored data. He has gained expertise in a great variety of statistical topics with a focus on the design and analysis of clinical trials. Arnošt Komárek is associate professor of statistics at Charles University, Prague. His subject area of expertise covers mainly survival analysis with the emphasis on interval-censored data and classification based

on longitudinal data. He is past chair of the Statistical Modelling Society?and editor of?Statistical Modelling: An International Journal. Emmanuel Lesaffre is professor of biostatistics at I-BioStat, KU Leuven. His research interests include Bayesian methods, longitudinal data analysis, statistical modelling, analysis of dental data, interval-censored data, misclassification issues, and clinical trials. He is the founding chair of the?Statistical Modelling Society, past-president of the?International Society for Clinical Biostatistics,?and fellow of?ISI?and?ASA.

Presents new models, methods, and techniques and considers important real-world applications in political science, sociology, economics, marketing, and finance Emphasizing interdisciplinary coverage, Bayesian Inference in the Social Sciences builds upon the recent growth in Bayesian methodology and examines an array of topics in model formulation, estimation, and applications. The book presents recent and trending developments in a diverse, yet closely integrated, set of research topics within the social sciences and facilitates the transmission of new ideas and methodology across disciplines while maintaining manageability, coherence, and a clear focus. Bayesian Inference in the Social Sciences features innovative methodology and novel applications in addition to new theoretical developments and modeling approaches, including the formulation and analysis of models with partial observability, sample selection, and incomplete data. Additional areas of inquiry include a Bayesian derivation of empirical likelihood and method of moment estimators, and the analysis of treatment effect models with endogeneity. The book emphasizes practical implementation, reviews and extends estimation algorithms, and examines innovative applications in a multitude of fields. Time series techniques and algorithms are discussed for

stochastic volatility, dynamic factor, and time-varying parameter models. Additional features include: Real-world applications and case studies that highlight asset pricing under fat-tailed distributions, price indifference modeling and market segmentation, analysis of dynamic networks, ethnic minorities and civil war, school choice effects, and business cycles and macroeconomic performance State-of-the-art computational tools and Markov chain Monte Carlo algorithms with related materials available via the book's supplemental website Interdisciplinary coverage from well-known international scholars and practitioners Bayesian Inference in the Social Sciences is an ideal reference for researchers in economics, political science, sociology, and business as well as an excellent resource for academic, government, and regulation agencies. The book is also useful for graduate-level courses in applied econometrics, statistics, mathematical modeling and simulation, numerical methods, computational analysis, and the social sciences.

A new approach for defining causality and such related notions as degree of responsibility, degrees of blame, and causal explanation. Causality plays a central role in the way people structure the world; we constantly seek causal explanations for our observations. But what does it even mean that an event C "actually caused" event E? The problem of defining actual causation goes beyond mere philosophical speculation. For example, in many legal arguments, it is precisely what needs to be established in order to determine responsibility. The philosophy literature has been struggling with the problem of defining causality since Hume. In this book, Joseph Halpern explores actual causality, and such related notions as degree of responsibility, degree of blame, and causal explanation. The goal is to arrive at a definition of causality that matches our natural language usage and is helpful, for example, to a

jury deciding a legal case, a programmer looking for the line of code that cause some software to fail, or an economist trying to determine whether austerity caused a subsequent depression. Halpern applies and expands an approach to causality that he and Judea Pearl developed, based on structural equations. He carefully formulates a definition of causality, and building on this, defines degree of responsibility, degree of blame, and causal explanation. He concludes by discussing how these ideas can be applied to such practical problems as accountability and program verification. Technical details are generally confined to the final section of each chapter and can be skipped by non-mathematical readers.

Benchmarking, Measuring, and OptimizingSecond BenchCouncil International Symposium, Bench 2019, Denver, CO, USA, November 14–16, 2019, Revised Selected PapersSpringer Nature

Many of our most urgent national problems suggest a widespread lack of concern for the future. Alarming economic conditions, such as low national savings rates, declining corporate investment in long-term capital projects, and ballooning private and public debt are matched by such social ills as diminished educational achievement, environmental degradation, and high rates of infant mortality, crime, and teenage pregnancy. At the heart of all these troubles lies an important behavioral phenomenon: in the role of consumer, manager, voter, student, or parent, many Americans choose inferior but immediate rewards over greater long-term benefits. Choice Over Time offers a rich sampling of original research on intertemporal choice—how and why people decide between immediate and delayed consequences—from a broad range of theoretical and methodological perspectives in philosophy, political science, psychology, and economics. George Loewenstein, Jon Elster, and their distinguished colleagues review existing

theories and forge new approaches to understanding significant questions: Why do people seem to "discount" future benefits? Do individuals use the same decision-making strategy in all aspects of their lives? What part is played by situational factors such as the certainty of delayed consequences? How are decisions affected by personal factors such as willpower and taste? In addressing these issues, the contributors to Choice Over Time address many social, economic, psychological, and personal time problems. Their work demonstrates the predictive power of short-term preferences in behavior as varied as addiction and phobia, the effect of prices on consumption, and the dramatic rise in debt and decline in savings. Choice Over Time provides an essential source for the most recent research and theory on intertemporal choice, offering new models for time preference patterns—and their aberrations—and presenting a diversity of potential solutions to the problem of "temporal myopia."