Theories of Probability
Foundations of Probabilistic Logic Programming
Good Thinking
Statistical Foundations of Data Science
Foundations of Risk Analysis
Foundations of Estimation Theory
Theories of Probability
Mathematical Foundations of Information Theory
Tutorials in Probability Theory
methods of prediction and testing and makes many statistical methods more transparent and widely usable. Its contributions to finance theory include purely game-theoretic accounts of Ito’s stochastic calculus, the capital asset pricing model, the equity premium, and portfolio theory. Game-Theoretic Foundations for Probability and Finance is a book of research. It is also a teaching resource. Each chapter is supplemented with carefully designed exercises, which relate to the new theory and to its historical context. Praise from many readers: “Ever since Kolmogorov’s Grundbegriffe, the standard mathematical treatment of probability theory has been measure-theoretic. In this groundbreaking work, Shafer and Vovk give a game-theoretic foundation instead. While being just as rigorous, the game-theoretic approach allows for vast and useful generalizations of classical measure-theoretic results, while also giving rise to new, radical ideas for prediction, statistics and mathematical finance without stochastic assumptions. “The authors set out their theory in great detail, resulting in what is definitely one of the most important books on the foundations of probability to have appeared in the last few decades.” – Peter Grünwald, CWI and University of Leiden “Shafer and Vovk have thoroughly re-written their 2001 book on the game-theoretic foundations for probability and for finance. They have included an account of the tremendous growth that has occurred since, in the game-theoretic and pathwise approaches to stochastic analysis and in their applications to continuous-time finance. This new book will undoubtedly spur a better understanding of the foundations of these very important fields, and we should all be grateful to its authors.” – Ioannis Karatzas, Columbia University

**The Foundations of Statistics**

This comprehensive study of probability considers the approaches of Pascal, Laplace, Poisson, and others. It also discusses Laws of Large Numbers, the theory of errors, and other relevant topics.

**Probability Theory in Finance**

Provides an introduction to modern statistical theory for social and health scientists while invoking minimal modeling assumptions.

**Foundations of Agnostic Statistics**

**Probability, Statistics, and Truth**

This volume considers fundamental theories and contrasts the natural interplay between real and abstract methods. No prior knowledge of probability is assumed. Numerous problems, most with hints. 1981 edition.

**Foundations of Probability**

**Foundations of Quantization for Probability Distributions**

Introducing many innovations in content and methods, this book involves the foundations, basic concepts, and fundamental results of probability theory. Geared toward readers seeking a firm basis for study of mathematical statistics or information theory, it also covers the mathematical notions of experiments and independence. 1970 edition.

**Mathematical Foundations of the Calculus of Probability**

A synthesis of foundational studies in Bayesian decision theory and statistics.

**The Foundations of Causal Decision Theory**

This volume collects the lectures on the foundations of physics given by eleven scientists at the University of Delaware. It is neither an anthology of disconnected items nor a smoothly running textbook but rather a progress report on a neglected yet vital area of basic physical research, namely foundations research. The investigation into the foundations of any branch of science is neither loose speculation nor popular science: it is an aspect of scientific research - in fact the deepest-searching part of basic research. Con sequently it must be carried out by the scientist himself. Thus whether the time concept is a numerical variable or a function, whether particle mechanics is the primary mechanical theory or a particular case of continuum mechanics, whether particle mechanics is the primary mechanical theory or a particular case of continuum mechanics, whether the field concept is dispensable, whether the covariance principle is a law or a regulative principle, whether quantum mechanics is completely detached from classical physics or contains fragments of it, whether it has annihilated the physical object or given a more complex picture of it, and to which extent the field variables measurable - all these are technical questions demanding a careful analysis of pieces of recent basic research. Yet all of these problems and indeed all questions in foundational research are philosophical as well as scientific.

**An Objective Theory of Probability (Routledge Revivals)**

The application of estimation theory renders the processing of experimental results both rational and effective, and thus helps not only to make our knowledge more precise but to determine the measure of its reliability. As a consequence, estimation theory is indispensable in the analysis of the measuring processes and of experiments in general. The knowledge necessary for studying this book encompasses the disciplines of probability and mathematical statistics as studied in the third or fourth year at university. For readers interested in applications, comparatively detailed chapters on linear and quadratic estimations, and normality of observation vectors have been included. Chapter 2 includes selected items of information from algebra, functional analysis and the theory of probability, intended to facilitate the reading of the text proper and to save the reader looking up individual theorems in various textbooks and papers; it is mainly devoted to the reproducing kernel Hilbert spaces, helpful in solving many estimation problems. The text proper of the book begins with Chapter 3. This is divided into two parts: the first deals with sufficient statistics, complete sufficient statistics, minimal sufficient statistics and relations between them; the second contains the most important inequalities of estimation theory for scalar and vector valued parameters and presents properties of the exponential family of distributions. The fourth chapter is an introduction to asymptotic methods of estimation. The method of statistical moments and the maximum-likelihood method are investigated. The sufficient conditions for asymptotical normality of the estimators are given for both methods. The linear and quadratic methods of estimation are dealt with in the fifth chapter. The method of least squares estimation is treated. Five basic regular versions of the regression model and the unified linear model of estimation are described. Unbiased estimators for unit dispersion (factor of the covariance matrix) are given for all mentioned cases. The equivalence of the least-squares method to the method of generalized minimum norm inversion of the design matrix of the regression model is studied in detail. The problem of estimating the covariance components in the mixed model is mentioned as well. Statistical properties of linear and quadratic estimators developed in the fifth chapter in the case of normally distributed errors of measurement are given in Chapter 6. Further, the application of tensor products of Hilbert spaces generated by the covariance matrix of random error vectors of observations is demonstrated. Chapter 7 reviews some further important methods of estimation theory. In the first part Wald's method of decision functions is applied to the construction of estimators. The method of contracted estimators and the method of Hoerl and Kennard are presented in the second part. The basic ideas of robustness and Bahadur's approach to estimation theory are presented in the third.
and fourth parts of this last chapter.

**Probability Theory**

Theories of Probability: An Examination of Foundations reviews the theoretical foundations of probability, with emphasis on concepts that are important for the modeling of random phenomena and the design of information processing systems. Topics covered range from axiomatic comparative and quantitative probability to the role of relative frequency in the measurement of probability. Computational complexity and random sequences are also discussed. Comprised of nine chapters, this book begins with an introduction to different types of probability theories, followed by a detailed account of axiomatic formalizations of comparative and quantitative probability and the relations between them. Subsequent chapters focus on the Kolmogorov formalization of quantitative probability; the common interpretation of probability as a limit of the relative frequency of the number of occurrences of an event in repeated, unlike trials of a random experiment; an improved theory for repeated random experiments; and the classical theory of probability. The book also examines the origin of subjective probability as a by-product of the development of individual judgments into decisions. Finally, it suggests that none of the known theories of probability covers the whole domain of engineering and scientific practice. This monograph will appeal to students and practitioners in the fields of mathematics and statistics as well as engineering and the physical and social sciences.

**Delaware Seminar in the Foundations of Physics**

Standard probability theory has been an enormously successful contribution to modern science. However, from many perspectives it is too narrow as a general theory of uncertainty, particularly for issues involving subjective uncertainty. This first-of-its-kind book is primarily based on qualitative approaches to probabilistic-like uncertainty, and includes qualitative theories for the standard theory as well as several of its generalizations. One of these generalizations produces a belief function composed of two functions: a probability function that measures the probabilistic strength of an uncertain event, and another function that measures the amount of ambiguity or vagueness of the event. Another unique approach of the book is to change the event space from a boolean algebra, which is closely linked to classical propositional logic, to a different event algebra that is closely linked to a well-studied generalization of classical propositional logic known as intuitionistic logic. Together, these new qualitative theories succeed where the standard probability theory fails by accounting for a number of puzzling empirical findings in the psychology of human probability judgments and decision making.

**Foundations of Stochastic Analysis**

This famous little book remains a foundational text for the understanding of probability theory, important both to students beginning a serious study of probability and to historians of modern mathematics. 1956 second edition.

**Theoretical Foundations of Functional Data Analysis, with an Introduction to Linear Operators**

First published in 1994. Routledge is an imprint of Taylor & Francis, an informa company.

**Probabilistic Foundations of Statistical Network Analysis**

**Elements of the Theory of Functions and Functional Analysis [Two Volumes in One]**

Statistical Foundations of Data Science gives a thorough introduction to commonly used statistical models, contemporary statistical machine learning techniques and algorithms, along with their mathematical insights and statistical theories. It aims to serve as a graduate-level textbook and a research monograph on high-dimensional statistics, sparsity and covariance learning, machine learning, and statistical inference. It includes ample exercises that involve both theoretical studies as well as empirical applications. The book begins with an introduction to the stylized features of big data and their impacts on statistical analysis. It then introduces multiple linear regression and expands the techniques of model building via nonparametric regression and kernel tricks. It provides a comprehensive account on sparsity explorations and model selections for multiple regression, generalized linear models, quantile regression, robust regression, hazards regression, among others. High-dimensional inference is also thoroughly addressed and so is feature screening. The book also provides a comprehensive account on high-dimensional covariance estimation, learning latent factors and hidden structures, as well as their applications to statistical estimation, inference, prediction and machine learning problems. It also introduces thoroughly statistical machine learning theory and methods for classification, clustering, and prediction. These include CART, random forests, boosting, support vector machines, clustering algorithms, sparse PCA, and deep learning.

**Probability Theory**

2012 Reprint of Volumes One and Two, 1957–1961. Exact facsimile of the original edition, not reproduced with Optical Recognition Software. A. N. Kolmogorov was a Soviet mathematician, preeminent in the 20th century, who advanced various scientific fields, among them probability theory, topology, logic, turbulence, classical mechanics and computational complexity. Later in life Kolmogorov changed his research interests to the area of turbulence, where his publications beginning in 1941 had a significant influence on the field. In classical mechanics, he is best known for the Kolmogorov-Arnold-Moser theorem. In 1957 he solved a particular interpretation of Hilbert's thirteenth problem (a joint work with his student V. I. Arnold). He was a founder of algorithmic complexity theory, often referred to as Kolmogorov complexity theory, which he began to develop around this time. Based on the authors' courses and lectures, this two-part advanced-level text is now available in a single volume. Topics include metric and normed spaces, continuous curves in metric spaces, measure theory, Lebesque intervals, Hilbert space, and more. Each section contains exercises. Lists of symbols, definitions, and theorems.

**Philosophical Foundations of Probability Theory**

This text provides a through, straightforward first course on basics statistics. Emphasizing the application of theory, it contains 200 fully worked examples and supplies exercises in each chapter—complete with hints and answers.

**Probability Foundations of Economic Theory**

Theoretical Foundations of Functional Data Analysis, with an Introduction to Linear Operators provides a uniquely broad compendium of the key mathematical concepts and results that are relevant for the theoretical development of functional data analysis (FDA). The self–contained treatment of
selected topics of functional analysis and operator theory includes reproducing kernel Hilbert spaces, singular value decomposition of compact operators on Hilbert spaces and perturbation theory for both self-adjoint and non self-adjoint operators. The probabilistic foundation for FDA is described from the perspective of random elements in Hilbert spaces as well as from the viewpoint of continuous time stochastic processes. Nonparametric estimation approaches including kernel and regularized smoothing are also introduced. These tools are then used to investigate the properties of estimators for the mean element, covariance operators, principal components, regression function and canonical correlations. A general treatment of canonical correlations in Hilbert spaces naturally leads to FDA formulations of factor analysis, regression, MANOVA and discriminant analysis. This book will provide a valuable reference for statisticians and other researchers interested in developing or understanding the mathematical aspects of FDA. It is also suitable for a graduate level special topics course.

**Game-Theoretic Foundations for Probability and Finance**

**Foundations of Statistical Mechanics**

index

**Probability Foundations for Engineers**

This book provides an introduction to the mathematical and algorithmic foundations of data science, including machine learning, high-dimensional geometry, and analysis of large networks. Topics include the counterintuitive nature of data in high dimensions, important linear algebraic techniques such as singular value decomposition, the theory of random walks and Markov chains, the fundamentals of and important algorithms for machine learning, algorithms and analysis for clustering, probabilistic models for large networks, representation learning including topic modelling and non-negative matrix factorization, wavelets and compressed sensing. Important probabilistic techniques are developed including the law of large numbers, tail inequalities, analysis of random projections, generalization guarantees in machine learning, and moment methods for analysis of phase transitions in large random graphs. Additionally, important structural and complexity measures are discussed such as matrix norms and VC-dimension. This book is suitable for both undergraduate and graduate courses in the design and analysis of algorithms for data.

**Foundations of Data Science**

This clear exposition begins with basic concepts and moves on to combination of events, dependent events and random variables, Bernoulli trials and the De Moivre-Laplace theorem, and more. Includes 150 problems, many with answers.

**Foundations and Philosophy of Epistemic Applications of Probability Theory**

The book also contains a major new discussion of what it means to suppose that some event occurs or that some proposition is true.

**Foundations of Probability Theory, Statistical Inference, and Statistical Theories of Science**

First comprehensive introduction to information theory explores the work of Shannon, McMillan, Feinstein, and Khinchin. Topics include the entropy concept in probability theory, fundamental theorems, and other subjects. 1957 edition.

**Random Measures, Theory and Applications**

International Series of Monographs in Natural Philosophy, Volume 22: Foundations of Statistical Mechanics: A Deductive Treatment presents the main approaches to the basic problems of statistical mechanics. This book examines the theory that provides explicit recognition to the limitations on one’s powers of observation. Organized into six chapters, this volume begins with an overview of the main physical assumptions and their idealization in the form of postulates. This text then examines the consequences of these postulates that culminate in a derivation of the fundamental formula for calculating probabilities in terms of dynamic quantities. Other chapters provide a careful analysis of the significant notion of entropy, which shows the links between thermodynamics and statistical mechanics and also between communication theory and statistical mechanics. The final chapter deals with the thermodynamic concept of entropy. This book is intended to be suitable for students of theoretical physics. Probability theorists, statisticians, and philosophers will also find this book useful.

**Modern Probability Theory and Its Applications**

Proceedings of an International Research Colloquium held at the University of Western Ontario, 10-13 May 1973.

**Rethinking the Foundations of Statistics**

Unique for its broad and yet comprehensive coverage of modern probability theory, ranging from first principles and standard textbook material to more advanced topics. In spite of the economical exposition, careful proofs are provided for all main results. After a detailed discussion of classical limit theorems, martingales, Markov chains, random walks, and stationary processes, the author moves on to a modern treatment of Brownian motion, L=82vy processes, weak convergence, It=93 calculus, Feller processes, and SDEs. The more advanced parts include material on local time, excursions, and additive functionals, diffusion processes, PDEs and potential theory, predictable processes, and general semimartingales. Though primarily intended as a general reference for researchers and graduate students in probability theory and related areas of analysis, the book is also suitable as a text for graduate and seminar courses on all levels, from elementary to advanced. Numerous easy to more challenging exercises are provided, especially for the early chapters. From the author of “Random Measures”.

**Mathematical Foundations of Information Theory**

**Foundations of the Theory of Probability**

These sparkling essays by a gifted thinker offer philosophical views on the roots of statistical interference. A pioneer in the early development of computing, Irving J. Good made fundamental contributions to the theory of Bayesian inference and was a key member of the team that broke the German Enigma code during World War II. Good maintains that a grasp of probability is essential to answering both practical and philosophical questions. This compilation of his most accessible works concentrates on philosophical rather than mathematical subjects, ranging from rational decisions, randomness, and the nature of probability to operational research, artificial intelligence, cognitive psychology, and chess. These twenty-three
self-contained articles represent the author's work in a variety of fields but are unified by a consistently rational approach. Five closely related sections explore Bayesian rationality; probability; corroboration, hypothesis testing, and simplicity; information and surprise; and causality and explanation. A comprehensive index, abundant references, and a bibliography refer readers to classic and modern literature. Good's thought-provoking observations and memorable examples provide scientists, mathematicians, and historians of science with a coherent view of probability and its applications.

**Foundations of Modern Probability**

Offering the first comprehensive treatment of the theory of random measures, this book has a very broad scope, ranging from basic properties of Poisson and related processes to the modern theories of convergence, stationarity, Palm measures, conditioning, and compensation. The three large final chapters focus on applications within the areas of stochastic geometry, excursion theory, and branching processes. Although this theory plays a fundamental role in most areas of modern probability, much of it, including the most basic material, has previously been available only in scores of journal articles. The book is primarily directed towards researchers and advanced graduate students in stochastic processes and related areas.

**Foundations of the theory of probability**

Suitable for a first course in probability theory and designed specifically for industrial engineering and operations management students, Probability Foundations for Engineers covers theory in an accessible manner and includes numerous practical examples based on engineering applications. Essentially, everyone understands and deals with probability every day in their normal lives. Nevertheless, for some reason, when engineering students who have good math skills are presented with the mathematics of probability theory, there is a disconnect somewhere. The book begins with a summary of set theory and then introduces probability and its axioms. The author has carefully avoided a theorem-proof type of presentation. He includes all of the theory but presents it in a conversational rather than formal manner, while relying on the assumption that undergraduate engineering students have a solid mastery of calculus. He explains mathematical theory by demonstrating how it is used with examples based on engineering applications. An important aspect of the text is the fact that examples are not presented in terms of "balls in urns". Many examples relate to gambling with coins, dice and cards but most are based on observable physical phenomena familiar to engineering students.

**Mathematical Foundations of Infinite-Dimensional Statistical Models**

Classic analysis of the foundations of statistics and development of personal probability, one of the greatest controversies in modern statistical thought. Revised edition. Calculus, probability, statistics, and Boolean algebra are recommended.

**Foundations of Statistics**

Due to the rapidly increasing need for methods of data compression, quantization has become a flourishing field in signal and image processing and information theory. The same techniques are also used in statistics (cluster analysis), pattern recognition, and operations research (optimal location of service centers). The book gives the first mathematically rigorous account of the fundamental theory underlying these applications. The emphasis is on the asymptotics of quantization errors for absolutely continuous and special classes of singular probabilities (surface measures, self-similar measures) presenting some new results for the first time. Written for researchers and graduate students in probability theory the monograph is of potential interest to all people working in the disciplines mentioned above.