Introduction To Stochastic Processes Lawler

Conformally Invariant Processes in the PlaneStochastic Processes and CalculusRandom Walk and the Heat EquationApplied Probability Models with Optimization ApplicationsIntroduction to Stochastic Processes with RBrownian MotionHigh-Dimensional ProbabilityIntroduction to Mathematical FinanceProbability and StochasticsIntersections of Random WalksIntroduction to Stochastic ProcessesLectures on Contemporary ProbabilityRandom Walk: A Modern IntroductionAdventures in Stochastic ProcessesAn Introduction to Stochastic ModelingEssentials of Stochastic ProcessesStochastic Processes and ModelsFractals in Probability and AnalysisAn Introduction to Stochastic ProcessesProbability and Stochastic ProcessesSTOCHASTIC PROCESSES, 2ND EDProbability on GraphsUpper and Lower Bounds for Stochastic ProcessesFinancial ModelingAn Introduction to Stochastic ModelingStochastic ProcessesAdvanced Probability Theory, Second Edition,Introduction to ProbabilityMultiparameter ProcessesProbability and Phase TransitionElements of Applied Stochastic ProcessesBrownian Motion, Martingales, and Stochastic CalculusBrownian MotionAn Introduction to Stochastic Processes with Applications to BiologyIntroduction to ProbabilityMarkov Chains and Mixing Times: Second EditionProbability SpaceIntroduction to Stochastic ProcessesClassical and Spatial Stochastic ProcessesIntroduction to the Mathematics of Finance

Conformally Invariant Processes in the Plane

Market_Desc: · Statisticians· Engineers· Computer Scientists· Senior/Graduate Level Students· Professors of Stochastics Processes Special Features: · Focuses on the application of stochastic process with emphasis on queuing networks and reversibility. · Describes processes from a probabilistic instead of an analytical point of view. About The Book: The book provides a non measure theoretic introduction to stochastic processes, probabilistic intuition and insight in thinking about problems. This revised edition contains additional material on compound Poisson random variables including an identity which can be used to efficiently compute moments, Poisson approximations; and coverage of the mean time spent in transient states as well as examples relating to the Gibb's sampler, the Metropolis algorithm and mean cover time in star graphs.

Stochastic Processes and Calculus

An introduction to simple stochastic processes and models, this text includes numerous exercises, problems and solutions, as well as covering key concepts and tools.

Random Walk and the Heat Equation

This comprehensive guide to stochastic processes gives a complete overview of the theory and addresses the most important applications. Pitched at a level accessible to beginning graduate students and researchers from applied disciplines, it is both a course book and a rich resource for individual readers. Subjects covered include Brownian motion, stochastic calculus, stochastic

differential equations, Markov processes, weak convergence of processes and semigroup theory. Applications include the Black–Scholes formula for the pricing of derivatives in financial mathematics, the Kalman–Bucy filter used in the US space program and also theoretical applications to partial differential equations and analysis. Short, readable chapters aim for clarity rather than full generality. More than 350 exercises are included to help readers put their new-found knowledge to the test and to prepare them for tackling the research literature.

Applied Probability Models with Optimization Applications

Concise advanced-level introduction to stochastic processes that arise in applied probability. Poisson process, renewal theory, Markov chains, Brownian motion, much more. Problems. References. Bibliography. 1970 edition.

Introduction to Stochastic Processes with R

This text introduces engineering students to probability theory and stochastic processes. Along with thorough mathematical development of the subject, the book presents intuitive explanations of key points in order to give students the insights they need to apply math to practical engineering problems. The first seven chapters contain the core material that is essential to any introductory course. In one-semester undergraduate courses, instructors can select material from the remaining chapters to meet their individual goals. Graduate courses can cover all chapters in one semester.

Brownian Motion

Clear presentation employs methods that recognize computer-related aspects of theory. Topics include expectations and independence, Bernoulli processes and sums of independent random variables, Markov chains, renewal theory, more. 1975 edition.

High-Dimensional Probability

The purpose of this book is to provide a rigorous yet accessible introduction to the modern financial theory of security markets. The main subjects are derivatives and portfolio management. The book is intended to be used as a text by advanced undergraduates and beginning graduate students. It is also likely to be useful to practicing financial engineers, portfolio manager, and actuaries who wish to acquire a fundamental understanding of financial theory. The book makes heavy use of mathematics, but not at an advanced level. Various mathematical concepts are developed as needed, and computational examples are emphasized.

Introduction to Mathematical Finance

This is a mathematically rigorous introduction to fractals which emphasizes examples and fundamental ideas. Building up from basic techniques of geometric measure theory and probability, central topics such as Hausdorff dimension, self-similar sets and Brownian motion are introduced, as are more specialized topics,

including Kakeya sets, capacity, percolation on trees and the traveling salesman theorem. The broad range of techniques presented enables key ideas to be highlighted, without the distraction of excessive technicalities. The authors incorporate some novel proofs which are simpler than those available elsewhere. Where possible, chapters are designed to be read independently so the book can be used to teach a variety of courses, with the clear structure offering students an accessible route into the topic.

Probability and Stochastics

Theoretical physicists have predicted that the scaling limits of many two-dimensional lattice models in statistical physics are in some sense conformally invariant. This belief has allowed physicists to predict many quantities for these critical systems. The nature of these scaling limits has recently been described precisely by using one well-known tool, Brownian motion, and a new construction, the Schramm-Loewner evolution (SLE). This book is an introduction to the conformally invariant processes that appear as scaling limits. The following topics are covered: stochastic integration; complex Brownian motion and measures derived from Brownian motion; conformal mappings and univalent functions; the Loewner differential equation and Loewner chains; the Schramm-Loewner evolution (SLE), which is a Loewner chain with a Brownian motion input; and applications to intersection exponents for Brownian motion. The prerequisites are first-year graduate courses in real analysis, complex analysis, and probability. The book is suitable for graduate students and research mathematicians interested in random processes and their applications in theoretical physics.

Intersections of Random Walks

High-dimensional probability offers insight into the behavior of random vectors, random matrices, random subspaces, and objects used to quantify uncertainty in high dimensions. Drawing on ideas from probability, analysis, and geometry, it lends itself to applications in mathematics, statistics, theoretical computer science, signal processing, optimization, and more. It is the first to integrate theory, key tools, and modern applications of high-dimensional probability. Concentration inequalities form the core, and it covers both classical results such as Hoeffding's and Chernoff's inequalities and modern developments such as the matrix Bernstein's inequality. It then introduces the powerful methods based on stochastic processes, including such tools as Slepian's, Sudakov's, and Dudley's inequalities, as well as generic chaining and bounds based on VC dimension. A broad range of illustrations is embedded throughout, including classical and modern results for covariance estimation, clustering, networks, semidefinite programming, coding, dimension reduction, matrix completion, machine learning, compressed sensing, and sparse regression.

Introduction to Stochastic Processes

This text is an introduction to the modern theory and applications of probability and stochastics. The style and coverage is geared towards the theory of stochastic processes, but with some attention to the applications. In many instances the gist

of the problem is introduced in practical, everyday language and then is made precise in mathematical form. The first four chapters are on probability theory: measure and integration, probability spaces, conditional expectations, and the classical limit theorems. There follows chapters on martingales, Poisson random measures, Levy Processes, Brownian motion, and Markov Processes. Special attention is paid to Poisson random measures and their roles in regulating the excursions of Brownian motion and the jumps of Levy and Markov processes. Each chapter has a large number of varied examples and exercises. The book is based on the author's lecture notes in courses offered over the years at Princeton University. These courses attracted graduate students from engineering, economics, physics, computer sciences, and mathematics. Erhan Cinlar has received many awards for excellence in teaching, including the President's Award for Distinguished Teaching at Princeton University. His research interests include theories of Markov processes, point processes, stochastic calculus, and stochastic flows. The book is full of insights and observations that only a lifetime researcher in probability can have, all told in a lucid yet precise style.

Lectures on Contemporary Probability

Backward stochastic differential equations (BSDEs) provide a general mathematical framework for solving pricing and risk management questions of financial derivatives. They are of growing importance for nonlinear pricing problems such as CVA computations that have been developed since the crisis. Although BSDEs are well known to academics, they are less familiar to practitioners in the financial industry. In order to fill this gap, this book revisits financial modeling and computational finance from a BSDE perspective, presenting a unified view of the pricing and hedging theory across all asset classes. It also contains a review of quantitative finance tools, including Fourier techniques, Monte Carlo methods, finite differences and model calibration schemes. With a view to use in graduate courses in computational finance and financial modeling, corrected problem sets and Matlab sheets have been provided. Stéphane Crépey's book starts with a few chapters on classical stochastic processes material, and then fasten your seatbelt the author starts traveling backwards in time through backward stochastic differential equations (BSDEs). This does not mean that one has to read the book backwards, like a manga! Rather, the possibility to move backwards in time, even if from a variety of final scenarios following a probability law, opens a multitude of possibilities for all those pricing problems whose solution is not a straightforward expectation. For example, this allows for framing problems like pricing with credit and funding costs in a rigorous mathematical setup. This is, as far as I know, the first book written for several levels of audiences, with applications to financial modeling and using BSDEs as one of the main tools, and as the song says: "it's never as good as the first time". Damiano Brigo, Chair of Mathematical Finance, Imperial College London While the classical theory of arbitrage free pricing has matured, and is now well understood and used by the finance industry, the theory of BSDEs continues to enjoy a rapid growth and remains a domain restricted to academic researchers and a handful of practitioners. Crépey's book presents this novel approach to a wider community of researchers involved in mathematical modeling in finance. It is clearly an essential reference for anyone interested in the latest developments in financial mathematics. Marek Musiela, Deputy Director of the Oxford-Man Institute of Quantitative Finance

Random Walk: A Modern Introduction

The book develops modern methods and in particular the "generic chaining" to bound stochastic processes. This methods allows in particular to get optimal bounds for Gaussian and Bernoulli processes. Applications are given to stable processes, infinitely divisible processes, matching theorems, the convergence of random Fourier series, of orthogonal series, and to functional analysis. The complete solution of a number of classical problems is given in complete detail, and an ambitious program for future research is laid out.

Adventures in Stochastic Processes

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

An Introduction to Stochastic Modeling

Self-contained presentation: from elementary material to state-of-the-art research; Much of the theory in book-form for the first time; Connections are made between probability and other areas of mathematics, engineering and mathematical physics

Essentials of Stochastic Processes

This 3rd edition of the successful Elements of Applied Stochastic Processes improves on the last edition by condensing the material and organising it into a more teachable format. It provides more in-depth coverage of Markov chains and simple Markov process and gives added emphasis to statistical inference in stochastic processes. Integration of theory and application offers improved teachability Provides a comprehensive introduction to stationary processes and time series analysis Integrates a broad set of applications into the text Utilizes a wealth of examples from research papers and monographs

Stochastic Processes and Models

The revised and expanded edition of this textbook presents the concepts and applications of random processes with the same illuminating simplicity as its first edition, but with the notable addition of substantial modern material on biological modeling. While still treating many important problems in fields such as engineering and mathematical physics, the book also focuses on the highly relevant topics of cancerous mutations, influenza evolution, drug resistance, and immune response. The models used elegantly apply various classical stochastic models presented earlier in the text, and exercises are included throughout to reinforce essential concepts. The second edition of Classical and Spatial Stochastic Processes is suitable as a textbook for courses in stochastic processes at the advanced-undergraduate and graduate levels, or as a self-study resource for researchers and practitioners in mathematics, engineering, physics, and mathematical biology. Reviews of the first edition: An appetizing textbook for a first course in stochastic processes. It guides the reader in a very clever manner from classical ideas to some of the most interesting modern results. All essential facts are presented with clear proofs, illustrated by beautiful examples. The book is well organized, has informative chapter summaries, and presents interesting exercises. The clear proofs are concentrated at the ends of the chapters making it easy to find the results. The style is a good balance of mathematical rigorosity and user-friendly explanation. —Biometric Journal This small book is well-written and well-organized. Only simple results are treated but at the same time many ideas needed for more complicated cases are hidden and in fact very close. The second part is a really elementary introduction to the area of spatial processes. All sections are easily readable and it is rather tentative for the reviewer to learn them more deeply by organizing a course based on this book. The reader can be really surprised seeing how simple the lectures on these complicated topics can be. At the same time such important questions as phase transitions and their properties for some models and the estimates for certain critical values are discussed rigorously. This is indeed a first course on stochastic processes and also a masterful introduction to some modern chapters of the theory. —Zentralblatt Math

Fractals in Probability and Analysis

This eagerly awaited textbook covers everything the graduate student in probability wants to know about Brownian motion, as well as the latest research in the area. Starting with the construction of Brownian motion, the book then proceeds to sample path properties like continuity and nowhere differentiability. Notions of fractal dimension are introduced early and are used throughout the book to describe fine properties of Brownian paths. The relation of Brownian motion and random walk is explored from several viewpoints, including a development of the theory of Brownian local times from random walk embeddings. Stochastic integration is introduced as a tool and an accessible treatment of the potential theory of Brownian motion clears the path for an extensive treatment of intersections of Brownian paths. An investigation of exceptional points on the Brownian path and an appendix on SLE processes, by Oded Schramm and Wendelin Werner, lead directly to recent research themes.

An Introduction to Stochastic Processes

An introduction to stochastic processes through the use of R Introduction to Stochastic Processes with R is an accessible and well-balanced presentation of the theory of stochastic processes, with an emphasis on real-world applications of probability theory in the natural and social sciences. The use of simulation, by means of the popular statistical freeware R, makes theoretical results come alive with practical, hands-on demonstrations. Written by a highly-qualified expert in the field, the author presents numerous examples from a wide array of disciplines, which are used to illustrate concepts and highlight computational and theoretical results. Developing readers' problem-solving skills and mathematical maturity, Introduction to Stochastic Processes with R features: Over 200 examples and 600 end-of-chapter exercises A tutorial for getting started with R, and appendices that contain review material in probability and matrix algebra Discussions of many timely and interesting supplemental topics including Markov chain Monte Carlo, random walk on graphs, card shuffling, Black-Scholes options pricing, applications in biology and genetics, cryptography, martingales, and stochastic calculus Introductions to mathematics as needed in order to suit readers at many mathematical levels A companion website that includes relevant data files as well as all R code and scripts used throughout the book Introduction to Stochastic Processes with R is an ideal textbook for an introductory course in stochastic processes. The book is aimed at undergraduate and beginning graduate-level students in the science, technology, engineering, and mathematics disciplines. The book is also an excellent reference for applied mathematicians and statisticians who are interested in a review of the topic.

Probability and Stochastic Processes

This work thoroughly covers the concepts and main results of probability theory, from its fundamental principles to advanced applications. This edition provides examples early in the text of practical problems such as the safety of a piece of engineering equipment or the inevitability of wrong conclusions in seemingly accurate medical tests for AIDS and cancer.;College or university bookstores may order five or more copies at a special student price which is available upon request from Marcel Dekker, Inc.

STOCHASTIC PROCESSES, 2ND ED

The modern subject of mathematical finance has undergone considerable development, both in theory and practice, since the seminal work of Black and Scholes appeared a third of a century ago. This book is intended as an introduction to some elements of the theory that will enable students and researchers to go on to read more advanced texts and research papers. The book begins with the development of the basic ideas of hedging and pricing of European and American derivatives in the discrete (i.e., discrete time and discrete state) setting of binomial tree models. Then a general discrete finite market model is introduced, and the fundamental theorems of asset pricing are proved in this setting. Tools from probability such as conditional expectation, filtration, (super)martingale, equivalent martingale measure, and martingale representation are all used first in this simple

discrete framework. This provides a bridge to the continuous (time and state) setting, which requires the additional concepts of Brownian motion and stochastic calculus. The simplest model in the continuous setting is the famous Black-Scholes model, for which pricing and hedging of European and American derivatives are developed. The book concludes with a description of the fundamental theorems for a continuous market model that generalizes the simple Black-Scholes model in several directions.

Probability on Graphs

Random walks are stochastic processes formed by successive summation of independent, identically distributed random variables and are one of the most studied topics in probability theory. This contemporary introduction evolved from courses taught at Cornell University and the University of Chicago by the first author, who is one of the most highly regarded researchers in the field of stochastic processes. This text meets the need for a modern reference to the detailed properties of an important class of random walks on the integer lattice. It is suitable for probabilists, mathematicians working in related fields, and for researchers in other disciplines who use random walks in modeling.

Upper and Lower Bounds for Stochastic Processes

Serving as the foundation for a one-semester course in stochastic processes for students familiar with elementary probability theory and calculus, Introduction to Stochastic Modeling, Fourth Edition, bridges the gap between basic probability and an intermediate level course in stochastic processes. The objectives of the text are to introduce students to the standard concepts and methods of stochastic modeling, to illustrate the rich diversity of applications of stochastic processes in the applied sciences, and to provide exercises in the application of simple stochastic analysis to realistic problems. New to this edition: Realistic applications from a variety of disciplines integrated throughout the text, including more biological applications Plentiful, completely updated problems Completely updated and reorganized end-of-chapter exercise sets, 250 exercises with answers New chapters of stochastic differential equations and Brownian motion and related processes Additional sections on Martingale and Poisson process Realistic applications from a variety of disciplines integrated throughout the text Extensive end of chapter exercises sets, 250 with answers Chapter 1-9 of the new edition are identical to the previous edition New! Chapter 10 - Random Evolutions New! Chapter 11- Characteristic functions and Their Applications

Financial Modeling

Emphasizing fundamental mathematical ideas rather than proofs, Introduction to Stochastic Processes, Second Edition provides quick access to important foundations of probability theory applicable to problems in many fields. Assuming that you have a reasonable level of computer literacy, the ability to write simple programs, and the access to software for linear algebra computations, the author approaches the problems and theorems with a focus on stochastic processes evolving with time, rather than a particular emphasis on measure theory. For those

lacking in exposure to linear differential and difference equations, the author begins with a brief introduction to these concepts. He proceeds to discuss Markov chains, optimal stopping, martingales, and Brownian motion. The book concludes with a chapter on stochastic integration. The author supplies many basic, general examples and provides exercises at the end of each chapter. New to the Second Edition: Expanded chapter on stochastic integration that introduces modern mathematical finance Introduction of Girsanov transformation and the Feynman-Kac formula Expanded discussion of Itô's formula and the Black-Scholes formula for pricing options New topics such as Doob's maximal inequality and a discussion on self similarity in the chapter on Brownian motion Applicable to the fields of mathematics, statistics, and engineering as well as computer science, economics, business, biological science, psychology, and engineering, this concise introduction is an excellent resource both for students and professionals.

An Introduction to Stochastic Modeling

As humans face defeat at the hands of the alien Fallers, four Earth dwellers travel deep into space to test a theory, and hopefully defeat their enemy, in the epic conclusion of the Probability Trilogy, which began with Probability Moon and Probability Sun. Reprint.

Stochastic Processes

A central study in Probability Theory is the behavior of fluctuation phenomena of partial sums of different types of random variable. One of the most useful concepts for this purpose is that of the random walk which has applications in many areas, particularly in statistical physics and statistical chemistry. Originally published in 1991, Intersections of Random Walks focuses on and explores a number of problems dealing primarily with the nonintersection of random walks and the self-avoiding walk. Many of these problems arise in studying statistical physics and other critical phenomena. Topics include: discrete harmonic measure, including an introduction to diffusion limited aggregation (DLA); the probability that independent random walks do not intersect; and properties of walks without self-intersections. The present softcover reprint includes corrections and addenda from the 1996 printing, and makes this classic monograph available to a wider audience. With a self-contained introduction to the properties of simple random walks, and an emphasis on rigorous results, the book will be useful to researchers in probability and statistical physics and to graduate students interested in basic properties of random walks.

Advanced Probability Theory, Second Edition,

Stochastic processes are necessary ingredients for building models of a wide variety of phenomena exhibiting time varying randomness. This text offers easy access to this fundamental topic for many students of applied sciences at many levels. It includes examples, exercises, applications, and computational procedures. It is uniquely useful for beginners and non-beginners in the field. No knowledge of measure theory is presumed.

Introduction to Probability

This volume describes the current state of knowledge of random spatial processes, particularly those arising in physics. The emphasis is on survey articles which describe areas of current interest to probabilists and physicists working on the probability theory of phase transition. Special attention is given to topics deserving further research. The principal contributions by leading researchers concern the mathematical theory of random walk, interacting particle systems, percolation, Ising and Potts models, spin glasses, cellular automata, quantum spin systems, and metastability. The level of presentation and review is particularly suitable for postgraduate and postdoctoral workers in mathematics and physics, and for advanced specialists in the probability theory of spatial disorder and phase transition.

Multiparameter Processes

This textbook gives a comprehensive introduction to stochastic processes and calculus in the fields of finance and economics, more specifically mathematical finance and time series econometrics. Over the past decades stochastic calculus and processes have gained great importance, because they play a decisive role in the modeling of financial markets and as a basis for modern time series econometrics. Mathematical theory is applied to solve stochastic differential equations and to derive limiting results for statistical inference on nonstationary processes. This introduction is elementary and rigorous at the same time. On the one hand it gives a basic and illustrative presentation of the relevant topics without using many technical derivations. On the other hand many of the procedures are presented at a technically advanced level: for a thorough understanding, they are to be proven. In order to meet both requirements jointly, the present book is equipped with a lot of challenging problems at the end of each chapter as well as with the corresponding detailed solutions. Thus the virtual text - augmented with more than 60 basic examples and 40 illustrative figures - is rather easy to read while a part of the technical arguments is transferred to the exercise problems and their solutions.

Probability and Phase Transition

An Introduction to Stochastic Processes with Applications to Biology, Second Edition presents the basic theory of stochastic processes necessary in understanding and applying stochastic methods to biological problems in areas such as population growth and extinction, drug kinetics, two-species competition and predation, the spread of epidemics, and the genetics of inbreeding. Because of their rich structure, the text focuses on discrete and continuous time Markov chains and continuous time and state Markov processes. New to the Second Edition A new chapter on stochastic differential equations that extends the basic theory to multivariate processes, including multivariate forward and backward Kolmogorov differential equations and the multivariate Itô’s formula The inclusion of examples and exercises from cellular and molecular biology Double the number of exercises and MATLAB® programs at the end of each chapter Answers and hints to selected exercises in the appendix Additional references from the literature This

edition continues to provide an excellent introduction to the fundamental theory of stochastic processes, along with a wide range of applications from the biological sciences. To better visualize the dynamics of stochastic processes, MATLAB programs are provided in the chapter appendices.

Elements of Applied Stochastic Processes

Brownian motion is one of the most important stochastic processes in continuous time and with continuous state space. Within the realm of stochastic processes, Brownian motion is at the intersection of Gaussian processes, martingales, Markov processes, diffusions and random fractals, and it has influenced the study of these topics. Its central position within mathematics is matched by numerous applications in science, engineering and mathematical finance. Often textbooks on probability theory cover, if at all, Brownian motion only briefly. On the other hand, there is a considerable gap to more specialized texts on Brownian motion which is not so easy to overcome for the novice. The authors' aim was to write a book which can be used as an introduction to Brownian motion and stochastic calculus, and as a first course in continuous-time and continuous-state Markov processes. They also wanted to have a text which would be both a readily accessible mathematical back-up for contemporary applications (such as mathematical finance) and a foundation to get easy access to advanced monographs. This textbook, tailored to the needs of graduate and advanced undergraduate students, covers Brownian motion, starting from its elementary properties, certain distributional aspects, path properties, and leading to stochastic calculus based on Brownian motion. It also includes numerical recipes for the simulation of Brownian motion.

Brownian Motion, Martingales, and Stochastic Calculus

This book is an introduction to the modern theory of Markov chains, whose goal is to determine the rate of convergence to the stationary distribution, as a function of state space size and geometry. This topic has important connections to combinatorics, statistical physics, and theoretical computer science. Many of the techniques presented originate in these disciplines. The central tools for estimating convergence times, including coupling, strong stationary times, and spectral methods, are developed. The authors discuss many examples, including card shuffling and the Ising model, from statistical mechanics, and present the connection of random walks to electrical networks and apply it to estimate hitting and cover times. The first edition has been used in courses in mathematics and computer science departments of numerous universities. The second edition features three new chapters (on monotone chains, the exclusion process, and stationary times) and also includes smaller additions and corrections throughout. Updated notes at the end of each chapter inform the reader of recent research developments.

Brownian Motion

This book offers a rigorous and self-contained presentation of stochastic integration and stochastic calculus within the general framework of continuous

semimartingales. The main tools of stochastic calculus, including Itô's formula, the optional stopping theorem and Girsanov's theorem, are treated in detail alongside many illustrative examples. The book also contains an introduction to Markov processes, with applications to solutions of stochastic differential equations and to connections between Brownian motion and partial differential equations. The theory of local times of semimartingales is discussed in the last chapter. Since its invention by Itô, stochastic calculus has proven to be one of the most important techniques of modern probability theory, and has been used in the most recent theoretical advances as well as in applications to other fields such as mathematical finance. Brownian Motion, Martingales, and Stochastic Calculus provides a strong theoretical background to the reader interested in such developments. Beginning graduate or advanced undergraduate students will benefit from this detailed approach to an essential area of probability theory. The emphasis is on concise and efficient presentation, without any concession to mathematical rigor. The material has been taught by the author for several years in graduate courses at two of the most prestigious French universities. The fact that proofs are given with full details makes the book particularly suitable for self-study. The numerous exercises help the reader to get acquainted with the tools of stochastic calculus.

An Introduction to Stochastic Processes with Applications to Biology

Building upon the previous editions, this textbook is a first course in stochastic processes taken by undergraduate and graduate students (MS and PhD students from math, statistics, economics, computer science, engineering, and finance departments) who have had a course in probability theory. It covers Markov chains in discrete and continuous time, Poisson processes, renewal processes, martingales, and option pricing. One can only learn a subject by seeing it in action, so there are a large number of examples and more than 300 carefully chosen exercises to deepen the reader's understanding. Drawing from teaching experience and student feedback, there are many new examples and problems with solutions that use TI-83 to eliminate the tedious details of solving linear equations by hand, and the collection of exercises is much improved, with many more biological examples. Originally included in previous editions, material too advanced for this first course in stochastic processes has been eliminated while treatment of other topics useful for applications has been expanded. In addition, the ordering of topics has been improved; for example, the difficult subject of martingales is delayed until its usefulness can be applied in the treatment of mathematical finance.

Introduction to Probability

The heat equation can be derived by averaging over a very large number of particles. Traditionally, the resulting PDE is studied as a deterministic equation, an approach that has brought many significant results and a deep understanding of the equation and its solutions. By studying the heat equation and considering the individual random particles, however, one gains further intuition into the problem. While this is now standard for many researchers, this approach is generally not presented at the undergraduate level. In this book, Lawler introduces the heat

equations and the closely related notion of harmonic functions from a probabilistic perspective. The theme of the first two chapters of the book is the relationship between random walks and the heat equation. This first chapter discusses the discrete case, random walk and the heat equation on the integer lattice; and the second chapter discusses the continuous case, Brownian motion and the usual heat equation. Relationships are shown between the two. For example, solving the heat equation in the discrete setting becomes a problem of diagonalization of symmetric matrices, which becomes a problem in Fourier series in the continuous case. Random walk and Brownian motion are introduced and developed from first principles. The latter two chapters discuss different topics: martingales and fractal dimension, with the chapters tied together by one example, a random Cantor set. The idea of this book is to merge probabilistic and deterministic approaches to heat flow. It is also intended as a bridge from undergraduate analysis to graduate and research perspectives. The book is suitable for advanced undergraduates, particularly those considering graduate work in mathematics or related areas.

Markov Chains and Mixing Times: Second Edition

This introduction to some of the principal models in the theory of disordered systems leads the reader through the basics, to the very edge of contemporary research, with the minimum of technical fuss. Topics covered include random walk, percolation, self-avoiding walk, interacting particle systems, uniform spanning tree, random graphs, as well as the Ising, Potts, and random-cluster models for ferromagnetism, and the Lorentz model for motion in a random medium. This new edition features accounts of major recent progress, including the exact value of the connective constant of the hexagonal lattice, and the critical point of the random-cluster model on the square lattice. The choice of topics is strongly motivated by modern applications, and focuses on areas that merit further research. Accessible to a wide audience of mathematicians and physicists, this book can be used as a graduate course text. Each chapter ends with a range of exercises.

Probability Space

This classroom-tested textbook is an introduction to probability theory, with the right balance between mathematical precision, probabilistic intuition, and concrete applications. Introduction to Probability covers the material precisely, while avoiding excessive technical details. After introducing the basic vocabulary of randomness, including events, probabilities, and random variables, the text offers the reader a first glimpse of the major theorems of the subject: the law of large numbers and the central limit theorem. The important probability distributions are introduced organically as they arise from applications. The discrete and continuous sides of probability are treated together to emphasize their similarities. Intended for students with a calculus background, the text teaches not only the nuts and bolts of probability theory and how to solve specific problems, but also why the methods of solution work.

Introduction to Stochastic Processes

This incorporation of computer use into teaching and learning stochastic processes

takes an applications- and computer-oriented approach rather than a mathematically rigorous approach. Solutions Manual available to instructors upon request. 1997 edition.

Classical and Spatial Stochastic Processes

An Introduction to Stochastic Modeling provides information pertinent to the standard concepts and methods of stochastic modeling. This book presents the rich diversity of applications of stochastic processes in the sciences. Organized into nine chapters, this book begins with an overview of diverse types of stochastic models, which predicts a set of possible outcomes weighed by their likelihoods or probabilities. This text then provides exercises in the applications of simple stochastic analysis to appropriate problems. Other chapters consider the study of general functions of independent, identically distributed, nonnegative random variables representing the successive intervals between renewals. This book discusses as well the numerous examples of Markov branching processes that arise naturally in various scientific disciplines. The final chapter deals with queueing models, which aid the design process by predicting system performance. This book is a valuable resource for students of engineering and management science. Engineers will also find this book useful.

Introduction to the Mathematics of Finance

Based on lectures and computer labs held at the IAS/Park City Mathematics Institute, this book presents areas of current research in modern probability that are accessible to undergraduate students. The subjects include: random walks, Brownian motion, card shuffling, spanning trees, and Markov chain Monte Carlo. There are computer simulations for random walks, Markov chains, stochastic differential equations as applied to finance, and other topics.