

David Freedman

Approximating Countable Markov Chains



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Approximating Countable Markov Chains

William J. Anderson



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Approximating Countable Markov Chains David Freedman, 2012-12-06 A long time ago I started writing a book about Markov chains Brownian motion and diffusion I soon had two hundred pages of manuscript and my publisher was enthusiastic Some years and several drafts later I had a thousand pages of manuscript and my publisher was less enthusiastic So we made it a trilogy Markov Chains Brownian Motion and Diffusion Approximating Countable Markov Chains familiarly MC B if you can follow Sections 10 4 to 10 9 of Markov Chains you re in The first two books are quite independent of one another and completely independent of this one which is a monograph explaining one way to think about chains with instantaneous states The results here are supposed to be new except when there are specific disclaimers It s written in the framework of Markov chains we wanted to reprint in this volume the MC chapters needed for reference but this proved impossible Most of the proofs in the trilogy are new and I tried hard to make them explicit The old ones were often elegant but I seldom saw what made them go With my own I can sometimes show you why things work And as I will argue in a minute my demonstrations are easier technically If I wrote them down well enough you may come to agree

Approximation countable Markov chains David Freedman, 1972 Markov Processes and Controlled Markov Chains Zhenting Hou, Jerzy A. Filar, Anyue Chen, 2013-12-01 The general theory of stochastic processes and the more specialized theory of Markov processes evolved enormously in the second half of the last century In parallel the theory of controlled Markov chains or Markov decision processes was being pioneered by control engineers and operations researchers Researchers in Markov processes and controlled Markov chains have been for a long time aware of the synergies between these two subject areas However this may be the first volume dedicated to highlighting these synergies and almost certainly it is the first volume that emphasizes the contributions of the vibrant and growing Chinese school of probability The chapters that appear in this book reflect both the maturity and the vitality of modern day Markov processes and controlled Markov chains They also will provide an opportunity to trace the connections that have emerged between the work done by members of the Chinese school of probability and the work done by the European US Central and South American and Asian scholars

Markov Chains David Freedman, 2012-12-06 A long time ago I started writing a book about Markov chains Brownian motion and diffusion I soon had two hundred pages of manuscript and my publisher was enthusiastic Some years and several drafts later I had a thousand pages of manuscript and my publisher was less enthusiastic So we made it a trilogy Markov Chains Brownian Motion and Diffusion Approximating Countable Markov Chains familiarly MC B if you can follow Sections 10 4 to 10 9 of Markov Chains you re in The first two books are quite independent of one another and completely independent of the third This last book is a monograph which explains one way to think about chains with instantaneous states The results in it are supposed to be new except where there are specific disclaimers it s written in the framework of Markov Chains Most of the proofs in the trilogy are new and I tried hard to make them explicit The old ones were often

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Generators of Markov Chains Adam Bobrowski,2021 A clear explanation of what an explosive Markov chain does after it passes through all available states in finite time

Introduction to Matrix Analytic Methods in Stochastic Modeling G. Latouche,V. Ramaswami,1999-01-01 Matrix analytic methods are popular as modeling tools because they give one the ability to construct and analyze a wide class of queuing models in a unified and algorithmically tractable way The authors present the basic mathematical ideas and algorithms of the matrix analytic theory in a readable up to date and comprehensive manner In the current literature a mixed bag of techniques is used some probabilistic some from linear algebra and some from transform methods Here many new proofs that emphasize the unity of the matrix analytic approach are included

Continuous Parameter Markov Processes and Stochastic Differential Equations Rabi Bhattacharya,Edward C. Waymire,2023-11-16 This graduate text presents the elegant and profound theory of continuous parameter Markov processes and many of its applications The authors focus on developing context and intuition before formalizing the theory of each topic illustrated with examples After a review of some background material the reader is introduced to semigroup theory including the Hille Yosida Theorem used to construct continuous parameter Markov processes Illustrated with examples it is a cornerstone of Feller s seminal theory of the most general one dimensional diffusions studied in a later chapter This is followed by two chapters with probabilistic constructions of jump Markov processes and processes with independent increments or Levy processes The greater part of the book is devoted to It s fascinating theory of stochastic differential equations and to the study of asymptotic properties of diffusions in all dimensions such as explosion transience recurrence existence of steady states and the speed of convergence to equilibrium A broadly applicable functional central limit theorem for ergodic Markov processes is presented with important examples Intimate connections between diffusions and linear second order elliptic and parabolic partial differential equations are laid out in two chapters and are used for computational purposes Among Special Topics chapters two study anomalous diffusions one on skew Brownian motion and the other on an intriguing multi phase homogenization of solute transport in porous media

Constructive Computation in Stochastic Models with Applications Quan-Lin Li,2011-02-02 Constructive Computation in Stochastic Models with Applications The RG Factorizations provides a unified constructive and algorithmic framework for numerical computation of many practical stochastic systems It summarizes recent important advances in computational study of stochastic models from several crucial directions such as stationary computation transient solution asymptotic analysis reward processes decision processes sensitivity analysis as well as game theory Graduate students researchers and practicing engineers in the field of operations research management sciences applied probability computer networks manufacturing systems transportation systems insurance and finance risk management and biological sciences will find this book valuable Dr Quan Lin Li is an

Associate Professor at the Department of Industrial Engineering of Tsinghua University China Continuous-Time Markov Chains William J. Anderson, 2012-12-06 Continuous time parameter Markov chains have been useful for modeling various random phenomena occurring in queueing theory genetics demography epidemiology and competing populations This is the first book about those aspects of the theory of continuous time Markov chains which are useful in applications to such areas It studies continuous time Markov chains through the transition function and corresponding q matrix rather than sample paths An extensive discussion of birth and death processes including the Stieltjes moment problem and the Karlin McGregor method of solution of the birth and death processes and multidimensional population processes is included and there is an extensive bibliography Virtually all of this material is appearing in book form for the first time Selected Works of A. N. Kolmogorov A.N. Shirayayev, 1992-02-29 The creative work of Andrei N Kolmogorov is exceptionally wide ranging In his studies on trigonometric and orthogonal series the theory of measure and integral mathematical logic approximation theory geometry topology functional analysis classical mechanics ergodic theory superposition of functions and in formation theory he solved many conceptual and fundamental problems and posed new questions which gave rise to a great deal of further research Kolmogorov is one of the founders of the Soviet school of probability theory mathematical statistics and the theory of turbulence In these areas he obtained a number of central results with many applications to mechanics geophysics linguistics and biology among other subjects This edition includes Kolmogorov's most important papers on mathematics and the natural sciences It does not include his philosophical and pedagogical studies his articles written for the Bolshaya Sovetskaya Entsiklopediya his papers on prosody and applications of mathematics or his publications on general questions The material of this edition was selected and compiled by Kolmogorov himself The first volume consists of papers on mathematics and also on turbulence and classical mechanics The second volume is devoted to probability theory and mathematical statistics The focus of the third volume is on information theory and the theory of algorithms Markov Processes for Stochastic Modeling Masaaki Kijima, 2013-12-19 This book presents an algebraic development of the theory of countable state space Markov chains with discrete and continuous time parameters A Markov chain is a stochastic process characterized by the Markov property that the distribution of future depends only on the current state not on the whole history Despite its simple form of dependency the Markov property has enabled us to develop a rich system of concepts and theorems and to derive many results that are useful in applications In fact the areas that can be modeled with varying degrees of success by Markov chains are vast and are still expanding The aim of this book is a discussion of the time dependent behavior called the transient behavior of Markov chains From the practical point of view when modeling a stochastic system by a Markov chain there are many instances in which time limiting results such as stationary distributions have no meaning Or even when the stationary distribution is of some importance it is often dangerous to use the stationary result alone without knowing the transient behavior of the Markov chain Not many books have paid much attention to this

topic despite its obvious importance Diffusions, Markov Processes, and Martingales: Volume 1, Foundations L. C. G. Rogers, David Williams, 2000-04-13 Now available in paperback this celebrated book has been prepared with readers needs in mind remaining a systematic guide to a large part of the modern theory of Probability whilst retaining its vitality The authors aim is to present the subject of Brownian motion not as a dry part of mathematical analysis but to convey its real meaning and fascination The opening heuristic chapter does just this and it is followed by a comprehensive and self contained account of the foundations of theory of stochastic processes Chapter 3 is a lively and readable account of the theory of Markov processes Together with its companion volume this book helps equip graduate students for research into a subject of great intrinsic interest and wide application in physics biology engineering finance and computer science **Cycle**

Representations of Markov Processes Sophia L. Kalpazidou, 2013-06-29 This book provides new insight into Markovian dependence via the cycle decompositions It presents a systematic account of a class of stochastic processes known as cycle or circuit processes so called because they may be defined by directed cycles An important application of this approach is the insight it provides to electrical networks and the duality principle of networks This expanded second edition adds new advances which reveal wide ranging interpretations of cycle representations such as homologic decompositions orthogonality equations Fourier series semigroup equations and disintegration of measures The text includes chapter summaries as well as a number of detailed illustrations A Modern Approach to Probability Theory Bert E. Fristedt, Lawrence F.

Gray, 2013-11-21 Overview This book is intended as a textbook in probability for graduate students in mathematics and related areas such as statistics economics physics and operations research Probability theory is a difficult but productive marriage of mathematical abstraction and everyday intuition and we have attempted to exhibit this fact Thus we may appear at times to be obsessively careful in our presentation of the material but our experience has shown that many students find themselves quite handicapped because they have never properly come to grips with the subtleties of the definitions and mathematical structures that form the foundation of the field Also students may find many of the examples and problems to be computationally challenging but it is our belief that one of the fascinating aspects of probability theory is its ability to say something concrete about the world around us and we have done our best to coax the student into doing explicit calculations often in the context of apparently elementary models The practical applications of probability theory to various scientific fields are far reaching and a specialized treatment would be required to do justice to the interrelations between probability and any one of these areas However to give the reader a taste of the possibilities we have included some examples particularly from the field of statistics such as order statistics Dirichlet distributions and minimum variance unbiased estimation *Approximate Iterative Algorithms* Anthony Louis Almudevar, 2014-02-18 Iterative algorithms often rely on approximate evaluation techniques which may include statistical estimation computer simulation or functional approximation This volume presents methods for the study of approximate iterative algorithms providing tools for the derivation of error

bounds and convergence rates and for the optimal design of such

Continuous-Time Markov Chains and Applications George G. Yin, Qing Zhang, 2012-12-06 This book is concerned with continuous time Markov chains It develops an integrated approach to singularly perturbed Markovian systems and reveals interrelations of stochastic processes and singular perturbations In recent years Markovian formulations have been used routinely for numerous real world systems under uncertainties Quite often the underlying Markov chain is subject to rather frequent fluctuations and the corresponding states are naturally divisible to a number of groups such that the chain fluctuates very rapidly among different states within a group but jumps less frequently from one group to another Various applications in engineering economics and biological and physical sciences have posed increasing demands on an in depth study of such systems A basic issue common to many different fields is the understanding of the distribution and the structure of the underlying uncertainty Such needs become even more pressing when we deal with complex and/or large scale Markovian models whose closed form solutions are usually very difficult to obtain Markov chain a well known subject has been studied by a host of researchers for many years While nonstationary cases have been treated in the literature much emphasis has been on stationary Markov chains and their basic properties such as ergodicity recurrence and stability In contrast this book focuses on singularly perturbed nonstationary Markov chains and their asymptotic properties Singular perturbation theory has a long history and is a powerful tool for a wide variety of applications

Combinatorial Stochastic Processes Jim Pitman, 2006-05-11 The purpose of this text is to bring graduate students specializing in probability theory to current research topics at the interface of combinatorics and stochastic processes There is particular focus on the theory of random combinatorial structures such as partitions permutations trees forests and mappings and connections between the asymptotic theory of enumeration of such structures and the theory of stochastic processes like Brownian motion and Poisson processes

Diffusions, Markov Processes, and Martingales: Itô calculus L. C. G. Rogers, David Williams, 2000 This celebrated book has been prepared with readers needs in mind remaining a systematic treatment of the subject whilst retaining its vitality The second volume follows on from the first concentrating on stochastic integrals stochastic differential equations excursion theory and the general theory of processes Much effort has gone into making these subjects as accessible as possible by providing many concrete examples that illustrate techniques of calculation and by treating all topics from the ground up starting from simple cases Many of the examples and proofs are new some important calculational techniques appeared for the first time in this book Together with its companion volume this book helps equip graduate students for research into a subject of great intrinsic interest and wide application in physics biology engineering finance and computer science

Principles of Formal Quantitative Analysis Nathalie Bertrand, Clemens Dubslaff, Sascha Klüppelholz, 2025-08-29 This Festschrift is dedicated to Christel Baier in recognition of her contributions to the field of theoretical computer science particularly in formal methods temporal logics model checking and probabilistic systems After earning her doctorate from the University of Mannheim Christel Baier held

research and professorial positions in Mannheim and Bonn Since 2006 she has been a full professor of Algebraic and Logical Foundations of Computer Science at Technische Universität Dresden where she currently serves as the Dean of the Faculty of Computer Science In 2011 she was elected to the Academia Europaea She was the Editor in Chief of Acta Informatica from 2015 to 2022 and received an honorary doctorate from RWTH Aachen University in 2022 Among her many notable research achievements Christel Baier has shaped the foundations and practical applications of system verification She pioneered probabilistic model checking advanced techniques for model checking of continuous time Markov chains and coauthored the standard textbook Principles of Model Checking Beyond her research contributions she is widely respected within the scientific community Her service has included invited talks membership in key steering and program committees and organizing scientific events Christel Baier has mentored and guided many students and fellow scientists They appreciate her way of approaching every task with remarkable persistence focus and diligence Many of these collaborators were pleased to contribute to this volume and to celebrate joint work and successes

Advances in Knowledge Discovery and Data Mining Hisashi Kashima, Tsuyoshi Ide, Wen-Chih Peng, 2023-05-27 The 4 volume set LNAI 13935 13938 constitutes the proceedings of the 27th Pacific Asia Conference on Knowledge Discovery and Data Mining PAKDD 2023 which took place in Osaka Japan during May 25 28 2023 The 143 papers presented in these proceedings were carefully reviewed and selected from 813 submissions They deal with new ideas original research results and practical development experiences from all KDD related areas including data mining data warehousing machine learning artificial intelligence databases statistics knowledge engineering big data technologies and foundations

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