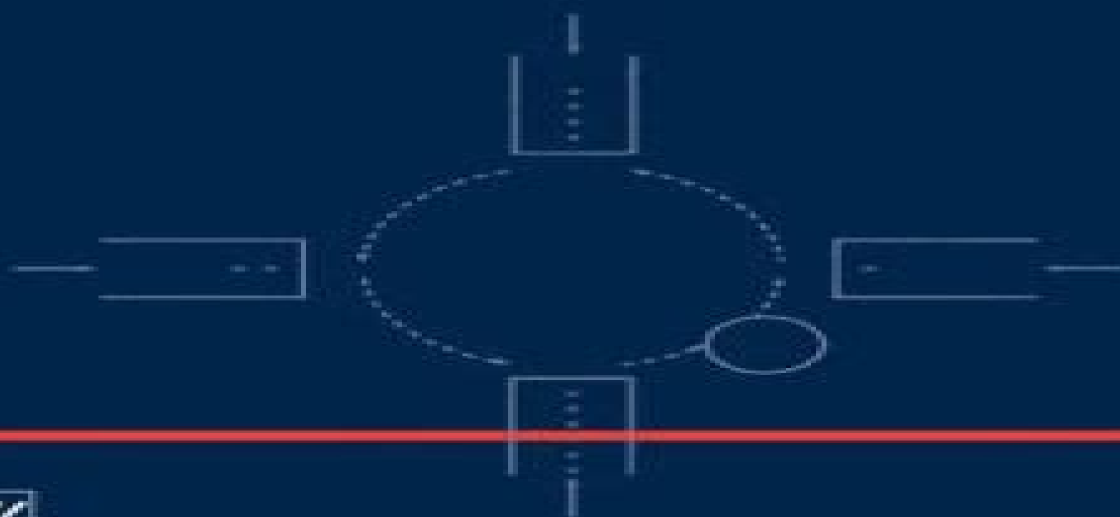
# Stochastic Dynamic Programming and the Control of Queueing Systems

Linn I. Sennott



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# Stochastic Dynamic Programming And The Control Of Queueing Systems

Mikhail Yu. Kitaev,Vladimir V. Rykov

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Feinberg,Adam Shwartz,2012-12-06 Eugene A Feinberg Adam Shwartz This volume deals with the theory of Markov Decision Processes MDPs and their applications Each chapter was written by a leading expert in the re spective area The papers cover major research areas and methodologies and discuss open questions and future research directions The papers can be read independently with the basic notation and concepts ofSection 1 2 Most chap ters should be accessible by graduate or advanced undergraduate students in fields of operations research electrical engineering and computer science 1 1 AN OVERVIEW OF MARKOV DECISION PROCESSES The theory of Markov Decision Processes also known under several other names including sequential stochastic optimization discrete time stochastic control and stochastic dynamic programming studiessequential optimization ofdiscrete time stochastic systems The basic object is a discrete time stochas tic system whose transition mechanism can be controlled over time Each control policy defines the stochastic process and values of objective functions associated with this process The goal is to select a good control policy In real life decisions that humans and computers make on all levels usually have two types ofimpacts i they cost orsavetime money or other resources or they bring revenues as well as ii they have an impact on the future by influencing the dynamics In many situations decisions with the largest immediate profit may not be good in view offuture events MDPs model this paradigm and provide results on the structure and existence of good policies and on methods for their calculation **System Reliability Theory** Marvin Rausand,Arnljot Hoyland,2003-12-05 A thoroughly updated and revised look at system reliability theory Since the first edition of this popular text was published nearly a decade ago new standards have changed the focus of reliability engineering and introduced new concepts and terminology not previously addressed in the engineering literature Consequently the Second Edition of System Reliability Theory Models Statistical Methods and Applications has been thoroughly rewritten and updated to meet current standards To maximize its value as a pedagogical tool the Second Edition features Additional chapters on reliability of maintained systems and reliability assessment of safety critical systems Discussion of basic assessment methods for operational availability and production regularity New concepts and terminology not covered in the first edition Revised sequencing of chapters for better pedagogical structure New problems examples and cases for a more applied focus An accompanying Web site with solutions overheads and supplementary information With its updated practical focus incorporation of industry feedback and many new examples based on real industry problems and data the Second Edition of this important text should prove to be more useful than ever for students instructors and researchers alike **Computational Science and Its Applications - ICCSA 2004** Antonio Laganà,Marina L. Gavrilova,Vipin Kumar,Youngsong Mun,C.J. Kenneth Tan,Osvaldo Gervasi,2004-05-21 The natural mission of Computational Science is to tackle all sorts of human problems and to work out intelligent automata aimed at alleviating the b den of working out suitable tools for solving complex problems For this reason ComputationalScience thoughoriginatingfromtheneedtosolvethemostch lenging problems in science and engineering computational science is the key player in the ght to gain fundamental advances in astronomy biology che stry environmental science physics and several other scienti c and engineering disciplines is increasingly turning its attention to all elds of human activity In all activities in fact intensive computation information handling kn ledge synthesis the use of ad hoc devices etc increasingly need to be exploited and coordinated regardless of the location of both the users and the various and heterogeneous computing platforms As a result the key to understanding the explosive growth of this discipline lies in two adjectives that more and more appropriately refer to Computational Science and its applications interoperable and ubiquitous Numerous examples of ubiquitous and interoperable tools and applicationsaregiveninthepresentfourLNCSvolumescontainingthecontri tions delivered at the 2004 International Conference on Computational Science and its Applications ICCSA 2004 held in Assisi Italy May 14 17 2004 Control Techniques for Complex Networks Sean Meyn,2008 From foundations to state of the art the tools and philosophy you need to build network models **Controlled Queueing Systems** Mikhail Yu. Kitaev,Vladimir V. Rykov,1995-08-30 This is the first book completely devoted to controlled queueing systems The book gathers the newest results of the theory of Markov decision processes related to queueing models and demonstrates their applications to main types of control in queueing systems including control of arrivals control of service mechanism and control of service discipline Emphasis is placed on conditions providing further good structural properties of Markov optimal strategies such as monotonicity threshold or hysteretic character and priority Each chapter is followed by exercises most of which allow the reader to complete technical fragments of proofs The text assumes the reader is familiar with standard courses of analysis probability theory and queueing theory

Numerical Methods in Finance Paolo Brandimarte,2003-09-29 Balanced coverage of the methodology and theory of numerical methods in finance Numerical Methods in Finance bridges the gap between financial theory and computational practice while helping students and practitioners exploit MATLAB for financial applications Paolo Brandimarte covers the basics of finance and numerical analysis and provides background material that suits the needs of students from both financial engineering and economics perspectives Classical numerical analysis methods optimization including less familiar topics such as stochastic and integer programming simulation including low discrepancy sequences and partial differential equations are covered in detail Extensive illustrative examples of the application of all of these methodologies are also provided The text is primarily focused on MATLAB based application but also includes descriptions of other readily available toolboxes that are relevant to finance Helpful appendices on the basics of MATLAB and probability theory round out this balanced coverage Accessible for students yet still a useful reference for practitioners Numerical Methods in Finance offers an expert introduction to powerful tools in finance **Simulation-Based Algorithms for Markov Decision Processes** Hyeong Soo Chang,Jiaqiao Hu,Michael C. Fu,Steven I. Marcus,2013-02-26 Markov decision process MDP models are widely used for modeling sequential decision making problems that arise in engineering economics computer science and the social sciences Many real world problems modeled by MDPs have huge state and or action spaces giving an opening to the curse of dimensionality and so making practical solution of the resulting models intractable In other cases the system of interest is too complex to allow explicit specification of some of the MDP model parameters but simulation samples are readily available e g for random transitions and costs For these settings various sampling and population based algorithms have been developed to overcome the difficulties of computing an optimal solution in terms of a policy and or value function Specific approaches include adaptive sampling evolutionary policy iteration evolutionary random policy search and model reference adaptive search This substantially enlarged new edition reflects the latest developments in novel algorithms and their underpinning theories and presents an updated account of the topics that have emerged since the publication of the first edition Includes innovative material on MDPs both in constrained settings and with uncertain transition properties game theoretic method for solving MDPs theories for developing roll out based algorithms and details of approximation stochastic annealing a population based on line simulation based algorithm The self contained approach of this book will appeal not only to researchers in MDPs stochastic modeling and control and simulation but will be a valuable source of tuition and reference for students of control and operations research Continuous-Time Markov Decision Processes Alexey Piunovskiy,Yi Zhang,2020-11-09 This book offers a systematic and rigorous treatment of continuous time Markov decision processes covering both theory and possible applications to queueing systems epidemiology finance and other fields Unlike most books on the subject much attention is paid to problems with functional constraints and the realizability of strategies Three major methods of investigations are presented based on dynamic programming linear programming and reduction to discrete time problems Although the main focus is on models with total discounted or undiscounted cost criteria models with average cost criteria and with impulsive controls are also discussed in depth The book is self contained A separate chapter is devoted to Markov pure jump processes and the appendices collect the requisite background on real analysis and applied probability All the statements in the main text are proved in detail Researchers and graduate students in applied probability operational research statistics and engineering will find this monograph interesting useful and valuable **Control of Spatially Structured Random Processes and Random Fields with Applications** Ruslan K. Chornei,Hans Daduna,Pavel S. Knopov,2006-09-03 This book is devoted to the study and optimization of spatiotem ral stochastic processes These are processes that simultaneously velop in space and time under random influences Such processes cur almost everywhere when the global behavior of complex systems is studied e g in physical and technical systems population dynamics neural networks computer and telecommunication networks complex production networks and flexible manufacturing systems logistic n works and transportation systems environmental engineering climate modeling and prediction earth surface models and so on In the study of spatiotemporal stochastic processes the classical c cepts of random fields which are models for spatially distributed r dom phenomena and of stochastic processes hich are usually thought to describe the evolution over time of systems under random influences converge Over the last twenty years many research monographs were written with emphasis on this unifying point of view as were a huge number of articles and papers on this subject Handbook of Industrial Engineering Gavriel Salvendy,2001-05-25 Unrivaled coverage of a broad spectrum of industrial engineering concepts and applications The Handbook of Industrial Engineering Third Edition contains a vast array of timely and useful methodologies for achieving increased productivity quality and competitiveness and improving the quality of working life in manufacturing and service industries This astoundingly comprehensive resource also provides a cohesive structure to the discipline of industrial engineering with four major classifications technology performance improvement management management planning and design control and decision making methods Completely updated and expanded to reflect nearly a decade of important developments in the field this Third Edition features a wealth of new information on project management supply chain management and logistics and systems related to service industries Other important features of this essential reference include More than 1 000 helpful tables graphs figures and formulas Step by step descriptions of hundreds of problem solving methodologies Hundreds of clear easy to follow application examples Contributions from 176 accomplished international professionals with diverse training and affiliations More than 4 000 citations for further reading The Handbook of Industrial Engineering Third Edition is an immensely useful one stop resource for industrial engineers and technical support personnel in corporations of any size continuous process and discrete part manufacturing industries and all types of service industries from healthcare to hospitality from retailing to finance Of related interest HANDBOOK OF HUMAN FACTORS AND ERGONOMICS Second Edition Edited by Gavriel Salvendy 0 471 11690 4 2 165 pages 60 chapters A comprehensive guide that contains practical knowledge and technical background on virtually all aspects of physical cognitive and social ergonomics As such it can be a valuable source of information for any individual or organization committed to providing competitive high quality products and safe productive work environments John F Smith Jr Chairman of the Board Chief Executive Officer and President General Motors Corporation From the Foreword *Information Technologies and Mathematical Modelling: Queueing Theory and Applications* Alexander Dudin,Alexander Gortsev,Anatoly Nazarov,Rafael Yakupov,2016-08-27 This book constitutes the refereed proceedings of the 15th International Scientific Conference on Information Technologies and Mathematical Modeling named after A F Terpugov ITMM 2016 held in Katun Russia in September 2016 The 33 full papers presented together with 4 short papers were carefully reviewed and selected from 96 submissions They are devoted to new results in the queueing theory and its applications addressing specialists in probability theory random processes mathematical modeling as well as engineers dealing with logical and technical design and operational management of telecommunication and computer networks Queueing Theory and Network Applications Tuan Phung-Duc,Shoji Kasahara,Sabine Wittevrongel,2019-08-22 This book constitutes the proceedings of the 14th International Conference on Queueing Theory and Network Applications QTNA 2019 held in Ghent Belgium in August 2019 The 23 full papers included in this volume were carefully reviewed and selected from 49 initial submissions The papers are organized in topical sections on Retrial Queues Controllable Queues Strategic Queues Queueing Networks Scheduling Policies Multidimensional Systems and Queueing Models in Applications SIAM Journal on Control and Optimization Society for Industrial and Applied Mathematics,2005 **Biostatistics** Gerald van Belle,Lloyd D. Fisher,Patrick J. Heagerty,Thomas Lumley,2004-10-06 A respected introduction to biostatistics thoroughly updated and revised The first edition of Biostatistics A Methodology for the Health Sciences has served professionals and students alike as a leading resource for learning how to apply statistical methods to the biomedical sciences This substantially revised Second Edition brings the book into the twenty first century for today s aspiring and practicing medical scientist This versatile reference provides a wide ranging look at basic and advanced biostatistical concepts and methods in a format calibrated to individual interests and levels of proficiency Written with an eye toward the use of computer applications the book examines the design of medical studies descriptive statistics and introductory ideas of probability theory and statistical inference explores more advanced statistical methods and illustrates important current uses of biostatistics New to this edition are discussions of Longitudinal data analysis Randomized clinical trials Bayesian statistics GEE The bootstrap method Enhanced by a companion Web site providing data sets selected problems and solutions and examples from such current topics as HIV AIDS this is a thoroughly current comprehensive introduction to the field **Scheduling and Control of Queueing Networks** Gideon Weiss,2021-10-14 Applications of queueing network models have multiplied in the last generation including scheduling of large manufacturing systems control of patient flow in health systems load balancing in cloud computing and matching in ride sharing These problems are too large and complex for exact solution but their scale allows approximation This book is the first comprehensive treatment of fluid scaling diffusion scaling and many server scaling in a single text presented at a level suitable for graduate students Fluid scaling is used to verify stability in particular treating max weight policies and to study optimal control of transient queueing networks Diffusion scaling is used to control systems in balanced heavy traffic by solving for optimal scheduling admission control and routing in Brownian networks Many server scaling is studied in the quality and efficiency driven Halfin Whitt regime and applied to load balancing in the supermarket model and to bipartite matching in ride sharing applications **Markov Decision Processes with Applications to Finance** Nicole Bäuerle,Ulrich Rieder,2011-06-06 The theory of Markov decision processes focuses on controlled Markov chains in discrete time The authors establish the theory for general state and action spaces and at the same time show its application by means of numerous examples mostly taken from the fields of finance and operations research By using a structural approach many technicalities concerning measure theory are avoided They cover problems with finite and infinite horizons as well as partially observable Markov decision processes piecewise deterministic Markov decision processes and stopping problems The book presents Markov decision processes in action and includes various state of the art applications with a particular view towards finance It is useful for upper level undergraduates Master s students and researchers in both applied probability and finance and provides exercises without solutions *Continuous-Time Markov Decision Processes* Xianping Guo,Onésimo Hernández-Lerma,2009-09-18 Continuous time Markov decision processes MDPs also known as controlled Markov chains are used for modeling decision making problems that arise in operations research for instance inventory manufacturing and queueing systems computer science communications engineering control of populations such as fisheries and epidemics and management science among many other fields This volume provides a unified systematic self contained presentation of recent developments on the theory and applications of continuous time MDPs The MDPs in this volume include most of the cases that arise in applications because they allow unbounded transition and reward cost rates Much of the material appears for the first time in book form

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