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Introduction to Linear Optimization - Dimitris Bertsimas 1997-01-01

Constrained Optimization and Lagrange Multiplier Methods - Dimitri P. Bertsekas 2014-05-10 Computer Science and Applied Mathematics: Constrained Optimization and Lagrange Multiplier Methods focuses on the advancements in the applications of the Lagrange multiplier methods for constrained minimization. The publication first offers information on the method of multipliers for equality constrained problems and the method of multipliers for inequality constrained and nondifferentiable optimization problems. Discussions focus on approximation procedures for nondifferentiable and ill-conditioned optimization problems; asymptotically exact minimization in F-norm methods of multipliers; duality framework for the method of multipliers; and the quadratic penalty function method. The text then examines exact penalty methods, including nondifferentiable exact penalty functions; linearization algorithms based on nondifferentiable exact penalty functions; differentiable exact penalty functions; and local and global convergence of Lagrangian methods. The book ponders on the nonquadratic penalty functions of convex programming. Topics include large scale separable integer programming problems and the exponential method of multipliers; classes of penalty functions and corresponding methods of multipliers; and convergence analysis of multiplier methods. The text is a valuable reference for mathematicians and researchers interested in the Lagrange multiplier methods.

Understanding and Using Linear Programming - Jiri Matousek 2007-07-04 The book is an introductory textbook mainly for students of computer science and mathematics. Our guiding phrase is "what every theoretical computer scientist should know about linear programming." A major focus is on applications of linear programming, both in practice and in theory. The book is concise, but at the same time, the main results are covered with complete proofs and in sufficient detail, ready for presentation in class. The book does not require more prerequisites than basic linear algebra, which is summarized in an appendix. One of its main goals is to help the reader to see linear programming "behind the scenes".

Linear Programming - Robert J Vanderbei 2013-07-16 This Fourth Edition introduces the latest theory and applications in optimization. It emphasizes constrained optimization, beginning with a substantial treatment of linear programming and then proceeding to convex analysis, network flows, integer programming, quadratic programming, and convex optimization. Readers will discover a host of practical business applications as well as non-business applications. Topics are clearly developed with many numerical examples worked out in detail. Specific examples and concrete algorithms precede more abstract topics. With its focus on solving practical problems, the book features free C programs to implement the major algorithms covered, including the two-phase simplex method, primal-dual simplex method, path-following interior-point method, and homogeneous self-dual methods. In addition, the author provides online JAVA applets that illustrate various pivot rules and variants of the simplex method, both for linear programming and for network flows. These C programs and JAVA tools can be found on the book's website. The website also includes new online instructional tools and exercises.

Robust Optimization - Aharon Ben-Tal 2009-08-10 Robust optimization is still a relatively new approach to optimization problems affected by uncertainty, but it has already proved so useful in real applications that it is difficult to tackle such problems today without considering this powerful methodology. Written by the principal developers of robust optimization, and describing the main achievements of a decade of research, this is the first book to provide a comprehensive and up-to-date account of the subject. Robust optimization is designed to meet some major challenges associated with uncertainty-affected optimization problems: to operate under lack of full information on the nature of uncertainty; to model the problem in a form that can be solved efficiently; and to provide guarantees about the performance of the solution. The book starts with a relatively simple treatment of uncertain linear programming, proceeding with a deep analysis of the interconnections between the construction of appropriate uncertainty sets and the classical chance constraints (probabilistic) approach. It then develops the robust optimization theory for uncertain conic quadratic and semidefinite optimization problems and dynamic (multistage) problems. The theory is supported by numerous examples and computational illustrations. An essential book for anyone working on optimization and decision making under uncertainty, Robust Optimization also makes an ideal graduate textbook on the subject.

Linear Optimization Problems with Inexact Data - Miroslav Fiedler 2006-07-18 Linear programming has attracted the interest of mathematicians since World War II when the first computers were constructed. Early attempts to apply linear programming methods practical problems failed, in part because of the inexactness of the data used to create the models. This book presents a comprehensive treatment of linear optimization with inexact
data, summarizing existing results and presenting new ones within a unifying framework.

Theory of Linear and Integer Programming—Alexander Schrijver 1998-06-11 Theory of Linear and Integer Programming Alexander Schrijver Centrum voor Wiskunde en Informatica, Amsterdam, The Netherlands This book describes the theory of linear and integer programming and surveys the algorithms for linear and integer programming problems, focusing on complexity analysis. It aims at complementing the more practically oriented books in this field. A special feature is the author's coverage of important recent developments in linear and integer programming. Applications to combinatorial optimization are given, and the author also includes extensive historical surveys and bibliographies. The book is intended for graduate students and researchers in operations research, mathematics and computer science. It will also be of interest to mathematical historians. Contents 1 Introduction and preliminaries; 2 Problems, algorithms, and complexity; 3 Linear algebra and complexity; 4 Theory of lattices and linear diophantine equations; 5 Algorithms for linear diophantine equations; 6 Diophantine approximation and basis reduction; 7 Fundamental concepts and results on polyhedra, linear inequalities, and linear programming; 8 The structure of polyhedra; 9 Polarity, and blocking and anti-blocking polyhedra; 10 Sizes and the theoretical complexity of linear inequalities and linear programming; 11 The simplex method; 12 Primal-dual, elimination, and relaxation methods; 13 Khachiyan's method for linear programming; 14 The ellipsoid method for polyhedra more generally; 15 Further polynomiality results in linear programming; 16 Introduction to integer linear programming; 17 Estimates in integer linear programming; 18 The complexity of integer linear programming; 19 Totally unimodular matrices: fundamental properties and examples; 20 Recognizing total unimodularity; 21 Further theory related to total unimodularity; 22 Integral polyhedra and total dual integrality; 23 Cutting planes; 24 Further methods in integer linear programming; Historical and further notes on integer linear programming; References; Notation index; Author index; Subject index

Linear Programming—Vasek Chvatal 1983-09-15 "This comprehensive treatment of the fundamental ideas and principles of linear programming covers basic theory, selected applications, network flow problems, and advanced techniques. Using specific examples to illustrate practical and theoretical aspects of the subject, the author clearly reveals the structures of fully detailed proofs. The presentation is geared toward modern efficient implementations of the simplex method and appropriate data structures for network flow problems. Completely self-contained, it develops every elementary facts on linear equations and matrices from the beginning."--Back cover.

Integer and Combinatorial Optimization—Laurence A. Wolsey 2014-08-28 Rave reviews for INTEGER AND COMBINATORIAL OPTIMIZATION "This book provides an excellent introduction and survey of traditional fields of combinatorial optimization . . . It is indeed one of the best and most complete texts on combinatorial optimization . . . available. [And with more than 700 entries, it] has quite an exhaustive reference list."--Optima "A unifying approach to optimization problems is to formulate them like linear programming problems, while restricting some or all of the variables to the integers. This book is an encyclopedia resource for such formulations, as well as for understanding the resulting integer programming problems."--Computing Reviews "[This book] can serve as a basis for various graduate courses on discrete optimization as well as a reference book for researchers and practitioners."--Mathematical Reviews "This comprehensive and wide-ranging book will undoubtedly become a standard reference book for all those in the field of combinatorial optimization. "Bulletin of the London Mathematical Society" This text should be required reading for anybody who intends to do research in this area or even just to keep abreast of developments."--Times Higher Education Supplement, London Also of interest . . . INTEGER PROGRAMMING Laurence A. Wolsey Comprehensive and self-contained, this intermediate-level guide to integer programming provides readers with clear, up-to-date explanations on why some problems are difficult to solve, how techniques can be reformulated to give better results, and how mixed integer programming systems can be used more effectively. 1998 (0-471-28366-5) 260 pp.

Mathematical Introduction to Linear Programming and Game Theory—Louis Brickman 2012-12-06 Mathematical elegance is a constant theme in this treatment of linear programming and matrix games. Condensed tableau, minimal in size and notation, are employed for the simplex algorithm. In the context of these tableau the beautiful termination theorem of R.G. Bland is proven more simply than heretofore, and the important duality theorem becomes almost obvious. Examples and extensive discussions throughout the book provide insight into definitions, theorems, and applications. There is considerable informal discussion on how best to play matrix games. The book is designed for a one-semester undergraduate course. Readers will need a degree of mathematical sophistication and general tools such as sets, functions, and summation notation. No single college course is a prerequisite, but most students will do better with some prior college mathematics. This thorough introduction to linear programming and game theory will impart a deep understanding of the material and also increase the student's mathematical maturity.

Stochastic Optimal Control—Dimitri P. Bertsekas 1961

Linear Programming: An Introduction to Finite Improvement Algorithms—Daniel Solow 2014-10-15 This text covers the basic theory and computation for a first course in linear programming, including substantial material on mathematical proof techniques and sophisticated computation methods. Includes Appendix on using Excel. 1984 edition.

Optimization Methods in Finance—Gerard Cornuejols 2006-12-21 Optimization models play an increasingly important role in financial decisions. This is the first textbook devoted to explaining how recent advances in optimization models, methods and software can be applied to solve problems in computational finance more efficiently and accurately. Chapters discussing the theory and efficient solution methods for all major classes of optimization problems alternate with chapters illustrating their use in modeling problems of mathematical finance. The reader is guided through topics such as volatility estimation, portfolio optimization problems and constructing an index fund, using techniques such as nonlinear optimization models, quadratic programming formulations and integer programming models respectively. The book is based on Master's courses in financial engineering and comes with worked examples, exercises and case studies. It will be welcomed by applied mathematicians, operational researchers and others who work in mathematical and computational finance and who are seeking a text for self-learning or for use with courses.

Integer Programming—Michele Conforti 2014-11-15 This book is an elegant and rigorous presentation of integer programming, exposing the subject's mathematical depth and broad applicability. Special attention is given to the theory behind the algorithms used in state-of-the-art solvers. An abundance of concrete examples and exercises of both theoretical and real-world interest explore the wide range of applications and ramifications of the theory. Each chapter is accompanied by an expertly informed guide to the literature and special topics, rounding out the reader's understanding and serving as a gateway to deeper study. Key topics include: formulations polyhedral theory cutting planes decomposition enumeration semidefinite relaxations Written by renowned experts in integer programming and combinatorial optimization, Integer Programming is destined to become an essential text in the field.

A Gentle Introduction to Optimization—B. Guenin 2014-07-31 Optimization is an essential technique for solving problems in areas as diverse as accounting, computer science and engineering. Assuming only basic linear algebra and with a clear focus on the fundamental concepts, this textbook is the perfect starting point for first- and second-year undergraduate students from a wide range of backgrounds and with varying levels of ability. Modern, real-world examples motivate the theory throughout. The authors keep the text as concise and focused as possible, with more advanced material treated separately or in starred exercises. Chapters are self-contained so that instructors and students can adapt the material to suit their own needs and a wide selection of over 140 exercises gives readers the opportunity to try out the skills they gain in each section. Solutions are available for instructors. The book also provides suggestions for further reading to help students take the next step to more advanced material.

Convex Optimization—Stephen Boyd 2004-03-08 A comprehensive introduction to the tools, techniques and applications of convex optimization.
Introduction to Mathematical Optimization - Xin-She Yang 2008 This book strives to provide a balanced coverage of efficient algorithms commonly used in solving mathematical optimization problems. It covers both the conventional algorithms and modern heuristic and metaheuristic methods. Topics include gradient-based algorithms such as Newton-Raphson method, steepest descent method, Hooke-Jeeves pattern search, Lagrange multipliers, linear programming, particle swarm optimization (PSO), simulated annealing (SA), and Tabu search. Multiojective optimization including important concepts such as Pareto optimality and utility method is also described. Three Matlab and Octave programs so as to demonstrate how PSO and SA work are provided. An example of demonstrating how to modify these programs to solve multiobjective optimization problems using recursive method is discussed.

Primal-dual Interior-Point Methods - Stephen J. Wright 1997 In the past decade, primal-dual algorithms have emerged as the most important and useful algorithms from the interior-point class. This book presents the major primal-dual algorithms for linear programming in straightforward terms. A thorough description of the theoretical properties of these methods is given, as are a discussion of practical and computational aspects and a summary of current software. This is an excellent, timely, and well-written work. The major primal-dual-algorithms covered in this book are path-following algorithms (short- and long-step, predictor-corrector), potential-reduction algorithms, and infeasible-interior-point algorithms. A unified treatment of superlinear convergence, finite termination, and detection of infeasible problems is presented. Issues relevant to practical implementation are also discussed, including sparse linear algebra and a complete specification of Mehrotra's predictor-corrector algorithm. Also treated are extensions of primal-dual algorithms to more general problems such as monotone complementarity, semidefinite programming, and general convex programming problems.

A First Course in Combinatorial Optimization - Jon Lee 2004-02-09 A First Course in Combinatorial Optimization is a text for a one-semester introductory graduate-level course for students of operations research, mathematics, and computer science. It is a self-contained treatment of the subject, requiring only some mathematical maturity. Topics include: linear and integer programming, polytopes, matroids and matroid optimization, matchings and networks, flows, and cuts. The book emphasizes the key principle underlying the successful integer-programming approach to combinatorial-optimization problems. Another key unifying topic is matroids. The author does not dwell on data structures and implementation details, preferring to focus on the key mathematical ideas that lead to useful models and algorithms. Problems and exercises are included throughout as well as references for further study.

Linear Programming - A. Sultan 2014-06-28 Includes one IBM/PC floppy disk. System Requirements: Monochrome monitors, IBM-compatible machines, minimum: 286 IBM, DOS 2.0 or higher. This book gives a complete, concise introduction to the theory and applications of linear programming. It emphasizes the practical applications of linear programming and makes the subject more accessible to individuals with varying mathematical abilities. It is one of the first rigorous linear programming texts that does not require linear algebra as a prerequisite. In addition, this text contains a floppy disk containing the program SIMPLEX, designed to help students solve problems using the computer. Key Features * Less rigorous mathematically - will appeal to individuals with varying mathematical abilities * Includes a floppy disk containing the program SIMPLEX and an appendix to help students solve problems using the computer * Includes chapters on network analysis and dynamic programming - topics of great interest to business majors and industrial engineers * Includes modem applications - selected computer programs for solving various max/min applications

Applied Mathematical Programming - Stephen P. Bradley 1977 Mathematical programming: an overview; solving linear programs; sensitivity analysis; duality in linear programming; mathematical programming in practice; integration of strategic and tactical planning in the aluminum industry; planning the mission and composition of the U.S. merchant Marine fleet; network models; integer programming; design of a naval tender job shop; dynamic programming; large-scale systems; nonlinear programming; a system for bank portfolio planning; vectors and matrices; linear programming in matrix form; a labeling algorithm for the maximum-flow network problem.

Semidefinite Optimization and Convex Algebraic Geometry - Grigory Blekherman 2013-03-21 An accessible introduction to convex algebraic geometry and semidefinite optimization. For graduate students and researchers in mathematics and computer science.

Nonlinear Programming 3 - 1978 Monotone operators and augmented lagrangian methods in nonlinear programming; The convergence of variable metric methods for nonlinearly constrained optimization calculations; A hybrid method for nonlinear programming; Two-phase algorithm for nonlinear constraint problems; Quasi-Newton methods for equality constrained optimization: equivalence of existing methods and a new implementation; An idealized exact penalty function; Exact penalty algorithms for nonlinear programming; A variable metric method for linearly constrained minimization problems; Solving systems of nonlinear equations by broyden's method with project updates; At the interface of modeling and algorithms research; Modeling combinatorial mathematical programming problems by netforms: an illustrative application; On the comparative evaluation of algorithms for mathematical programming problems.

Linear Optimization and Duality - Craig A. Tovey 2020-12-16 Linear Optimization and Duality: A Modern Exposition departs from convention in significant ways. Standard linear programming textbooks present the material in the order in which it was discovered. Duality is treated as a difficult add-on after coverage of formulation, the simplex method, and polyhedral theory. Students end up without knowing duality in their bones. This text brings in duality in Chapter 1 and carries duality all the way through the exposition. Chapter 1 gives a general definition of duality that shows the dual aspects of a matrix as a column of rows and a row of columns. The proof of weak duality in Chapter 2 is shown via the Lagrangian, which relies on matrix duality. The first three LP formulation examples in Chapter 3 are classic primal-dual pairs including the diet problem and 2-person zero sum games. For many engineering students, optimization is their first immersion in rigorous mathematics. Conventional texts assume a level of mathematical sophistication they don’t have. This text embeds dozens of reading tips and hundreds of answered questions to guide such students. Features Emphasis on duality throughout; A thorough treatment of the exposition of weak duality, which includes computational complexity and data structures Exercises and problems based on the learning theory concept of the zone of proximal development Guidance for the mathematically unsophisticated reader About the Author Craig A. Tovey is a professor in the H. Milton Stewart School of Industrial and Systems Engineering at Georgia Institute of Technology. Dr. Tovey received an AB from Harvard College, an MS in computer science and a PhD in operations research from Stanford University. His principal activities are in operations research and its interdisciplinary applications. He received a Presidential Young Investigator Award and the Jacob Wolfowitz Prize for research in heuristics. He was named an Institute Fellow at Georgia Tech, and was recognized by the ACM Special Interest Group on Electronic Commerce with the Test of Time Award. Dr. Tovey received the 2016 Golden Goose Award for his research on bee foraging behavior leading to the development of the Honey Bee Algorithm.

The Embryonic Development of Drosophila melanogaster - Jose A. Campos-Ortega 2013-03-09 “... but our knowledge is so weak that no philosopher or physicist will ever be able to completely explore the nature of even a fly...” * * * Thomas Aquinas “In Symbolum Apostolorum” 079 RSV p96 This is a monograph on embryogenesis of the fruit fly Drosophila melanogaster conceived as a reference book on morphology of embryonic development. A monograph of this extent and content is not yet available in the literature of Drosophila embryology, and we believe that there is an absolute need for it. Thanks to the progress achieved during the last ten years in the fields of deovel opmental and molecular genetics, work on Drosophila development has considerably expanded creating an even greater need for the information that we present here. Our own interest for wildtype embryonic development arose several years ago, when we began to study the development of mutants. While those studies were going on we repeatedly had occasion to state in sufficiencies in the existing literature about the embryology of the wildtype, so that we undertook investigating many of these problems by ourselves. Convinced that several of our colleagues will have encountered similar difficulties we decided to publish the present monograph. Although not expressly recorded, Thomas Aquinas probably referred to the domestic fly and not to the fruit fly. Irrespective of which fly he meant, however, we know that Thomas was right in any case.
Linear Optimization: Glenn Hurlbert 2009-11-09 The Subject A little explanation is in order for our choice of the title Linear Opti- mization (and corresponding terminology) for what has traditionally been called Linear Programming. The word programming in this context can be confusing and/or misleading to students. Linear programming problems are referred to as optimization problems but the general term linear program remains. This can cause people unfamiliar with the subject to think that it is about programming in the sense of writing computer code. It isn’t. This workbook is about the beautiful mathematics underlying the idea of optimizing linear functions subject to linear constraints and the algorithms to solve such problems. In particular, much of what we do- cuss is the mathematics of Simplex Algorithm for solving such problems, developed by George Dantzig in the late 1940s. The word program in linear programming is a historical artifact. When Dantzig rst developed the Simplex Algorithm to solve what are now called linear programming problems, his initial model was a class of resource location problems to be solved for the U.S. Air Force. The decisions about the locations were called Programs by the Air Force, and hence the term Linear Programming.

Linear Programming and Network Flows: Mokhtar S. Bazaraa 1990 Table of contents

The Design of Approximation Algorithms: David P. Williamson 2011-04-26 Discrete optimization problems are everywhere, from traditional operations research planning (scheduling, facility location and network design); to computer science databases; to advertising issues in viral marketing. Yet most such problems are NP-hard; unless \( P = NP \), there are no efficient algorithms to find optimal solutions. This book shows how to design approximation algorithms: efficient algorithms that find provably near-optimal solutions. The book is organized around central algorithmic techniques for designing approximation algorithms, including greedy and local search algorithms, dynamic programming, linear and semidefinite programming, and randomization. Each chapter in the first section is devoted to a single algorithmic technique applied to several different problems, with more sophisticated treatment in the second section. The book also covers methods for proving that optimization problems are hard to approximate. Designed as a textbook for graduate-level algorithm courses, it will also serve as a reference for researchers interested in the heuristic solution of discrete optimization problems.

Parametric Optimization: Jürgen Guddat 1990-12-21 Explores optimization problems in which some or all of the individual data involved depends on one parameter. Beginning with a preliminary survey of solution algorithms in one-parametric optimization, the text moves on to examine the pathfollowing curves of local minimizers, pathfollowing along a connected component in the Karush-Kuhn-Tucker set and in the critical set, pathfollowing in the set of local minimizers and in the set of critical points. In addition, practical applications are included.

The Next Wave in Computing, Optimization, and Decision Technologies: Bruce L. Golden 2006-10-13 Computer Science and Operations Research continue to have a synergistic relationship and this book represents the results of the cross-fertilization between OR/MS and CS/AI. It is this interface of OR/CS that makes possible advances that could not have been achieved in isolation. Taken collectively, these articles are indicative of the state of the art in the interface between OR/MS and CS/AI and of the high-caliber research being conducted by members of the INFORMS Computing Society.


The Analytics Edge: Dimitris Bertsimas 2016 “Provides a unified, insightful, modern, and entertaining treatment of analytics. The book covers the science of using data to build models, improve decisions, and ultimately add value to institutions and individuals”—Back cover.

Linear Programming with Duals: Craig A. Towey 2017-06-15 This textbook presents a theoretical treatment of linear programming, network flows and applications, integer programming, and computational complexity. The author includes a rigorous discussion of theory, numerous examples and exercises, and geometric intuitive explanations. He also offers computational tips and interpretation of software input. Unlike other books, this text incorporates duality throughout its chapters, rather than treating it as an add-on topic. It also discusses computational complexity theory, which can be used to classify problems according to the appropriate solution method.

How the World Computes: Barry S. Cooper 2012-05-28 This book constitutes the refereed proceedings of the Turing Centenary Conference and the 8th Conference on Computability in Europe, CiE 2012, held in Cambridge, UK, in June 2012. The 53 revised papers presented together with 6 invited lectures were carefully reviewed and selected with an acceptance rate of under 29.8%. The CiE 2012 Turing Centenary Conference will be remembered as a historic event in the continuing development of the powerful explanatory role of computability across a wide spectrum of research areas. The papers presented at CiE 2012 represent the best of current research in the area, and forms a fitting tribute to the short but brilliant trajectory of Alan Mathison Turing. Both the conference series and the association promote the development of computability-related science, ranging over mathematics, computer science and applications in various natural and engineering sciences such as physics and biology, and also including the promotion of related non-scientific fields such as philosophy and history of computing.

Mechanism Design: Rakesh V. Vohra 2011-05-09 Mechanism design is an analytical framework for thinking clearly and carefully about what exactly a given institution can achieve when the information necessary to make decisions is dispersed and privately held. This analysis provides an account of the underlying mathematics of mechanism design based on linear programming. Three advantages characterize the approach. The first is simplicity: arguments based on linear programming are both elementary and transparent. The second is unity: the machinery of linear programming provides a way to unify results from disparate areas of mechanism design. The third is reach: the technique offers the ability to solve problems that appear to be beyond solutions offered by traditional methods. No claim is made that the approach advocated should supplant traditional mathematical machinery. Rather, the approach represents an addition to the tools of the economic theorist who proposes to understand economic phenomena through the lens of mechanism design.

Mixed Integer Nonlinear Programming: Jon Lee 2011-12-02 Many engineering, operations, and scientific applications include a mixture of discrete and continuous decision variables and nonlinear relationships involving the decision variables that have pronounced effects on the set of feasible and optimal solutions. Mixed-integer nonlinear programming (MINLP) problems combine the numerical difficulties of handling nonlinear functions with the challenge of optimizing in the context of nonconvex functions and discrete variables. MINLP is one of the most flexible modeling paradigms available for optimization; but because its scope is so broad, in the most general cases it is hopelessly intractable. Nonetheless, an expanding body of researchers and practitioners—including chemical engineers, operations researchers, industrial engineers, mechanical engineers, economists, statisticians,
computer scientists, operations managers, and mathematical programmers — are interested in solving large-scale MINLP instances.

**Constrained Markov Decision Processes** Eitan Altman 1999-03-30 This book provides a unified approach for the study of constrained Markov decision processes with a finite state space and unbounded costs. Unlike the single controller case considered in many other books, the author considers a single controller with several objectives, such as minimizing delays and loss, probabilities, and maximization of throughputs. It is desirable to design a controller that minimizes one cost objective, subject to inequality constraints on other cost objectives. This framework describes dynamic decision problems arising frequently in many engineering fields. A thorough overview of these applications is presented in the introduction. The book is then divided into three sections that build upon each other. The first part explains the theory for the finite state space. The author characterizes the set of achievable expected occupation measures as well as performance vectors, and identifies simple classes of policies among which optimal policies exist. This allows the reduction of the original dynamic into a linear program. A Lagranian approach is then used to derive the dual linear program using dynamic programming techniques. In the second part, these results are extended to the infinite state space and action spaces. The author provides two frameworks: the case where costs are bounded below and the contracting framework. The third part builds upon the results of the first two parts and examines asymptotical results of the convergence of both the value and the policies in the time horizon and in the discount factor. Finally, several state truncation algorithms that enable the approximation of the solution of the original control problem via finite linear programs are given.