

5 1 Dual Simplex Algorithm Politecnico Di Milano

This comprehensive book provides the students with the basic knowledge of the processes involved in operations research and discusses the techniques of solutions to problems and their applications in daily life. Beginning with an overview of the operations research models and decision-making, the book describes in detail the various optimization techniques such as linear and non-linear programming, integer linear programming, dynamic programming, genetic programming, and network techniques such as PERT (program evaluation review technique) and CPM (critical path method). It also explains the transportation and assignment problems, queuing theory, games theory, sequencing, replacement and capital investment decisions and inventory. Besides, the book discusses the Monte Carlo simulation techniques for solving queuing, demand forecasting, inventory and scheduling problems and elaborates on genetic algorithms. Each mathematical technique is dealt with in two parts. The first part explains the theory underlying the methodology of solution to problems. The second part illustrates how the theory is applied to solve different kinds of problems. This book is designed as a textbook for the undergraduate students of mechanical engineering, electrical engineering, production and industrial engineering, computer science and engineering and information technology. Besides, the book will also be useful to the postgraduate students of production and industrial engineering, computer applications, business administration, commerce, mathematics and statistics. KEY FEATURES : Includes a large number of solved problems to help students comprehend the concepts with ease. Gives step-by-step explanation of algorithms by taking problems. Provides chapter-end exercises to drill the students in self-study.

This classic by a well-known expert explores both theory and applications. It focuses on linear programming, in addition to other programming topics, and features numerous worked-out examples and problems. 1961 edition.

This book constitutes revised and selected papers from the 18th International Conference on Mathematical Optimization Theory and Operations Research, MOTOR 2019, held in Ekaterinburg, Russia, in July 2019. The 40 full papers and 4 short papers presented in this volume were carefully reviewed and selected from a total of 170 submissions. The papers in the volume are organised according to the following topical headings: ?combinatorial optimization; game theory and mathematical economics; data mining and computational geometry; integer programming; mathematical programming; operations research; optimal control and applications.

For all students who wish to understand current economic and business literature, knowledge of mathematical methods has become a prerequisite. Clear and concise, with precise definitions and theorems, Werner and Sotskov cover all the major topics required to gain a firm grounding in this subject including sequences, series, applications in finance, functions, differentiations, differentials and difference equations, optimizations with and without constraints, integrations and much more. Containing exercises and worked examples, precise definitions and theorems as well as economic applications, this book provides the reader with a comprehensive understanding of the mathematical models and tools used in both economics and business.

The author have used numerical examples as the means for presentation of the underlying ideas of different operations research techniques. Accordingly, a large number of comprehensive solved examples, taken from a variety of fields, have been added in every chapter and they are followed by a set of unsolved problems with answers (and hints wherever required) through which readers can test their understanding of the subject matter. The book, in its present form, contains around 650 examples, 1,280 illustrative diagrams.

The authors have written a rigorous yet elementary and self-contained book to present, in a unified framework, generalized convex functions. The book also includes numerous exercises and two appendices which list the findings consulted.

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 mathematics, 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 modern applications - selected computer programs for solving various max/min applications

"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 illuminate 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 even elementary facts on linear equations and matrices from the beginning."--Back cover.

This book offers a comprehensive treatment of the exercises and case studies as well as summaries of the chapters of the book "Linear Optimization and Extensions" by Manfred Padberg. It covers the areas of linear programming and the optimization of linear functions over polyhedra in finite dimensional Euclidean vector spaces. Here are the main topics

treated in the book: Simplex algorithms and their derivatives including the duality theory of linear programming. Polyhedral theory, pointwise and linear descriptions of polyhedra, double description algorithms, Gaussian elimination with and without division, the complexity of simplex steps. Projective algorithms, the geometry of projective algorithms, Newtonian barrier methods. Ellipsoids algorithms in perfect and in finite precision arithmetic, the equivalence of linear optimization and polyhedral separation. The foundations of mixed-integer programming and combinatorial optimization.

Operations Research (OR) began as an interdisciplinary activity to solve complex military problems during World War II. Utilizing principles from mathematics, engineering, business, computer science, economics, and statistics, OR has developed into a full fledged academic discipline with practical application in business, industry, government and military. Currently regarded as a body of established mathematical models and methods essential to solving complicated management issues, OR provides quantitative analysis of problems from which managers can make objective decisions. Operations Research and Management Science (OR/MS) methodologies continue to flourish in numerous decision making fields. Featuring a mix of international authors, Operations Research and Management Science Handbook combines OR/MS models, methods, and applications into one comprehensive, yet concise volume. The first resource to reach for when confronting OR/MS difficulties, this text – Provides a single source guide in OR/MS Bridges theory and practice Covers all topics relevant to OR/MS Offers a quick reference guide for students, researchers and practitioners Contains unified and up-to-date coverage designed and edited with non-experts in mind Discusses software availability for all OR/MS techniques Includes contributions from a mix of domestic and international experts The 26 chapters in the handbook are divided into two parts. Part I contains 14 chapters that cover the fundamental OR/MS models and methods. Each chapter gives an overview of a particular OR/MS model, its solution methods and illustrates successful applications. Part II of the handbook contains 11 chapters discussing the OR/MS applications in specific areas. They include airlines, e-commerce, energy systems, finance, military, production systems, project management, quality control, reliability, supply chain management and water resources. Part II ends with a chapter on the future of OR/MS applications.

?With emphasis on computation, this book is a real breakthrough in the field of LP. In addition to conventional topics, such as the simplex method, duality, and interior-point methods, all deduced in a fresh and clear manner, it introduces the state of the art by highlighting brand-new and advanced results, including efficient pivot rules, Phase-I approaches, reduced simplex methods, deficient-basis methods, face methods, and pivotal interior-point methods. In particular, it covers the determination of the optimal solution set, feasible-point simplex method, decomposition principle for solving large-scale problems, controlled-branch method based on generalized reduced simplex framework for solving integer LP problems.

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".

Praise for the Second Edition: "This is quite a well-done book: very tightly organized, better-than-average exposition, and numerous examples, illustrations, and applications." —Mathematical Reviews of the American Mathematical Society An Introduction to Linear Programming and Game Theory, Third Edition presents a rigorous, yet accessible, introduction to the theoretical concepts and computational techniques of linear programming and game theory. Now with more extensive modeling exercises and detailed integer programming examples, this book uniquely illustrates how mathematics can be used in real-world applications in the social, life, and managerial sciences, providing readers with the opportunity to develop and apply their analytical abilities when solving realistic problems. This Third Edition addresses various new topics and improvements in the field of mathematical programming, and it also presents two software programs, LP Assistant and the Solver add-in for Microsoft Office Excel, for solving linear programming problems. LP Assistant, developed by coauthor Gerard Keough, allows readers to perform the basic steps of the algorithms provided in the book and is freely available via the book's related Web site. The use of the sensitivity analysis report and integer programming algorithm from the Solver add-in for Microsoft Office Excel is introduced so readers can solve the book's linear and integer programming problems. A detailed appendix contains instructions for the use of both applications. Additional features of the Third Edition include: A discussion of sensitivity analysis for the two-variable problem, along with new examples demonstrating integer programming, non-linear programming, and make vs. buy models Revised proofs and a discussion on the relevance and solution of the dual problem A section on developing an example in Data Envelopment Analysis An outline of the proof of John Nash's theorem on the existence of equilibrium strategy pairs for non-cooperative, non-zero-sum games Providing a complete mathematical development of all presented concepts and examples, Introduction to Linear Programming and Game Theory, Third Edition is an ideal text for linear programming and mathematical modeling courses at the upper-undergraduate and graduate levels. It also serves as a valuable reference for professionals who use game theory in business, economics, and management science. This paper develops a general form of neutrosophic linear fractional programming (NLFP) problem and proposed a novel model to solve it. In this method the NLFP problem is decomposed into two neutrosophic linear programming (NLP) problem. Furthermore, the problem has been solved by combination of dual simplex method and a special ranking function. In addition, the model is compared with an existing method. An illustrative example is shown for better understanding of the proposed method. The results show that the method is computationally very simple and comprehensible.

We take great pleasure in presenting to the readers the second thoroughly revised edition of the book after a number of reprints. The suggestions received from the readers have been carefully incorporated in this edition and almost the entire subject matter has been reorganised, revised and rewritten.

This major new volume provides business decisionmakers and analysts with a tool that provides a logical structure for understanding problems as well as a mathematical technique for solving them. The primary tool presented throughout Optimization for Profit is linear programming (LP)--a medium that can be mastered by any individual who seeks to improve his/her analytical and decisionmaking skills. One of the special features of Optimization for Profit is the illustration of activity analysis as the technique used to formulate problems. By using activity analysis as the problem structure, linear programming become a natural extension of the way decision makers approach problems. As a result, linear programming becomes an integral part of the thinking process of the individual. Consequently, students or practitioners can readily create a linear programming model of an entire business or any part of a business. Several chapters are devoted to describing this technique and illustrating its application to many different types of companies, including an oil refinery, a marmalade production company, and a chicken processing plant. A thorough study of Optimization for Profit will enable you to work with any manufacturer or service industry and model all or part of the operation, and then solve the model to determine how best to minimize costs or maximize profits. Many firms save hundreds of thousands of dollars each year through the application of linear programming. The authors have presented the material in this vital book so clearly and thoroughly that an individual could master the material through self-study. The inclusion of problems at the end of each chapter makes this book suitable as a textbook at the advanced undergraduate or beginning graduate level at most colleges or universities for students of management science, operations research personnel, and applied mathematicians working in industry, government, or academia. Notable features of the book include: the practical aspects of modeling a business or any part of a business using linear programming a unique approach to explain the simplex method for solving linear programming problems real life, practical problems that are presented and solved in detail detailed instructions for those interested in solving linear programming problems on all types of computers from mainframes to PCs numerous problems provided for the benefit of the student and all of the linear programming models described in these problems as well as in the text itself are available on a diskette

Operations Research is the discipline of applying advanced analytical methods to help make better decisions. It helps the management to achieve its goals by using scientific techniques, making the study and understanding of operations research even more important in the present day scenario. This book has been written with the objective of providing students with a comprehensive textbook on the subject. It follows a simple algorithmic approach to explain each concept, often giving different steps. This approach stems from the author's experience in teaching undergraduate and postgraduate students of Madras University and Anna University, Chennai, over many years. One of the highlights of this book is the solved-problems approach, as each chapter in the book is substantiated by a large number of solved problems. Many of the questions that have been incorporated are from previous examination papers of various universities. In addition, each chapter has numerous exercise problems at the end and a section on short questions with answers.

This book is based on the lecture notes of the author delivered to the students at the Institute of Science, Banaras Hindu University, India. It covers simplex, revised simplex, two-phase method, duality, dual simplex, complementary slackness, transportation and assignment problems with good number of examples, clear proofs, MATLAB codes and homework problems. The book will be useful for both students and practitioners.

Each concept is discussed from the basics and supported by sufficient mathematical background and worked examples. Suitable for individual or group learning, the book offers numerous end-of-chapter problems for study and review.

Linear Programming and Its Applications is intended for a first course in linear programming, preferably in the sophomore or junior year of the typical undergraduate curriculum. The emphasis throughout the book is on linear programming skills via the algorithmic solution of small-scale problems, both in the general sense and in the specific applications where these problems naturally occur. The book arose from lecture notes prepared during the years 1985-1987 while I was a graduate assistant in the Department of Mathematics at The Pennsylvania State University. I used a preliminary draft in a Methods of Management Science class in the spring semester of 1988 at Lock Haven University. Having been extensively tried and tested in the classroom at various stages of its development, the book reflects many modifications either suggested directly by students or deemed appropriate from responses by students in the classroom setting. My primary aim in writing the book was to address common errors and difficulties as clearly and effectively as I could.

This Third Edition introduces the latest theory and applications in optimization. It emphasizes constrained optimization, beginning with linear programming and then proceeding to convex analysis, network flows, integer programming, quadratic programming, and convex optimization. You'll discover a host of practical business applications as well as non-business applications. With its focus on solving practical problems, the book features free C programs to implement the major algorithms covered. The book's accompanying website includes the C programs, JAVA tools, and new online instructional tools and exercises.

The authoritative guide to modeling and solving complex problems with linear programming?extensively revised, expanded, and updated The only book to treat both linear programming techniques and network flows under one cover, Linear Programming and Network Flows, Fourth Edition has been completely updated with the latest developments on the topic. This new edition continues to successfully emphasize modeling concepts, the design and analysis of algorithms, and implementation strategies for problems in a

variety of fields, including industrial engineering, management science, operations research, computer science, and mathematics. The book begins with basic results on linear algebra and convex analysis, and a geometrically motivated study of the structure of polyhedral sets is provided. Subsequent chapters include coverage of cycling in the simplex method, interior point methods, and sensitivity and parametric analysis. Newly added topics in the Fourth Edition include: The cycling phenomenon in linear programming and the geometry of cycling Duality relationships with cycling Elaboration on stable factorizations and implementation strategies Stabilized column generation and acceleration of Benders and Dantzig-Wolfe decomposition methods Line search and dual ascent ideas for the out-of-kilter algorithm Heap implementation comments, negative cost circuit insights, and additional convergence analyses for shortest path problems The authors present concepts and techniques that are illustrated by numerical examples along with insights complete with detailed mathematical analysis and justification. An emphasis is placed on providing geometric viewpoints and economic interpretations as well as strengthening the understanding of the fundamental ideas. Each chapter is accompanied by Notes and References sections that provide historical developments in addition to current and future trends. Updated exercises allow readers to test their comprehension of the presented material, and extensive references provide resources for further study. Linear Programming and Network Flows, Fourth Edition is an excellent book for linear programming and network flow courses at the upper-undergraduate and graduate levels. It is also a valuable resource for applied scientists who would like to refresh their understanding of linear programming and network flow techniques.

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.

Elementary Linear Programming with Applications presents a survey of the basic ideas in linear programming and related areas. It also provides students with some of the tools used in solving difficult problems which will prove useful in their professional career. The text is comprised of six chapters. The Prologue gives a brief survey of operations research and discusses the different steps in solving an operations research problem. Chapter 0 gives a quick review of the necessary linear algebra. Chapter 1 deals with the basic necessary geometric ideas in R^n . Chapter 2 introduces linear programming with examples of the problems to be considered, and presents the simplex method as an algorithm for solving linear programming problems. Chapter 3 covers further topics in linear programming, including duality theory and sensitivity analysis. Chapter 4 presents an introduction to integer programming. Chapter 5 covers a few of the more important topics in network flows. Students of business, engineering, computer science, and mathematics will find the book very useful.

Today's rapidly changing marketplace can seem like a jungle for many professionals. Engineering & Management Press offers the books needed to navigate through the wilderness of business techniques and acronyms. EMP's titles provide practical information and proven business methods for most corporate and industrial environments. Our titles cover crucial, timely topics of importance to businesses and managers today -- management, productivity improvement, quality, and related issues. This revised and updated review is the only study guide written for industrial engineers. It tells test takers exactly what they need to know for the revised Professional Engineers' Exam. Filled with practical strategies for taking the test, the author presents and examines thoroughly the topics the examination will cover. Also serves as a resource industrial engineers can use throughout their careers.

This textbook provides students with fundamentals and advanced concepts in optimization and operations research. It gives an overview of the historical perspective of operations research and explains its principal characteristics, tools, and applications. The wide range of topics covered includes convex and concave functions, simplex methods, post optimality analysis of linear programming problems, constrained and unconstrained optimization, game theory, queueing theory, and related topics. The text also elaborates on project management, including the importance of critical path analysis, PERT and CPM techniques. This textbook is ideal for any discipline with one or more courses in optimization and operations research; it may also provide a solid reference for researchers and practitioners in operations research.

This guide book to mathematics contains in handbook form the fundamental working knowledge of mathematics which is needed as an everyday guide for working scientists and engineers, as well as for students. Easy to understand, and convenient to use, this guide book gives concisely the information necessary to evaluate most problems which occur in concrete applications.

Integer Programming: Theory, Applications, and Computations provides information pertinent to the theory, applications, and computations of integer programming. This book presents the computational advantages of the various techniques of integer programming. Organized into eight chapters, this book begins with an overview of the general categorization of integer applications and explains the three fundamental techniques of integer programming. This text then explores the concept of implicit enumeration, which is general in a sense that it is applicable to any well-defined binary program. Other chapters consider the branch-and-bound methods, the cutting-plane method, and its closely related asymptotic problem. This book discusses as well several specialized algorithms for certain well-known integer models and provides an alternative approach to the solution of the integer problem. The final chapter deals with a number of observations about the formulations and executions of integer programming models. This book is a valuable resource for industrial engineers and research workers.

Guides in the application of linear programming to firm decision making, with the goal of giving decision-makers a better understanding of methods at their disposal Useful as a main resource

or as a supplement in an economics or management science course, this comprehensive book addresses the deficiencies of other texts when it comes to covering linear programming theory—especially where data envelopment analysis (DEA) is concerned—and provides the foundation for the development of DEA. Linear Programming and Resource Allocation Modeling begins by introducing primal and dual problems via an optimum product mix problem, and reviews the rudiments of vector and matrix operations. It then goes on to cover: the canonical and standard forms of a linear programming problem; the computational aspects of linear programming; variations of the standard simplex theme; duality theory; single- and multiple- process production functions; sensitivity analysis of the optimal solution; structural changes; and parametric programming. The primal and dual problems are then reformulated and re-examined in the context of Lagrangian saddle points, and a host of duality and complementary slackness theorems are offered. The book also covers primal and dual quadratic programs, the complementary pivot method, primal and dual linear fractional functional programs, and (matrix) game theory solutions via linear programming, and data envelopment analysis (DEA). This book: Appeals to those wishing to solve linear optimization problems in areas such as economics, business administration and management, agriculture and energy, strategic planning, public decision making, and health care Fills the need for a linear programming applications component in a management science or economics course Provides a complete treatment of linear programming as applied to activity selection and usage Contains many detailed example problems as well as textual and graphical explanations Linear Programming and Resource Allocation Modeling is an excellent resource for professionals looking to solve linear optimization problems, and advanced undergraduate to beginning graduate level management science or economics students. Along with the traditional material concerning linear programming (the simplex method, the theory of duality, the dual simplex method), In-Depth Analysis of Linear Programming contains new results of research carried out by the authors. For the first time, the criteria of stability (in the geometrical and algebraic forms) of the general linear programming problem are formulated and proved. New regularization methods based on the idea of extension of an admissible set are proposed for solving unstable (ill-posed) linear programming problems. In contrast to the well-known regularization methods, in the methods proposed in this book the initial unstable problem is replaced by a new stable auxiliary problem. This is also a linear programming problem, which can be solved by standard finite methods. In addition, the authors indicate the conditions imposed on the parameters of the auxiliary problem which guarantee its stability, and this circumstance advantageously distinguishes the regularization methods proposed in this book from the existing methods. In these existing methods, the stability of the auxiliary problem is usually only presupposed but is not explicitly investigated. In this book, the traditional material contained in the first three chapters is expounded in much simpler terms than in the majority of books on linear programming, which makes it accessible to beginners as well as those more familiar with the area.

This self-contained beginning graduate text covers linear and integer programming, polytopes, matroids and matroid optimization, shortest paths, and network flows.

This book presents the latest findings on one of the most intensely investigated subjects in computational mathematics--the traveling salesman problem. It sounds simple enough: given a set of cities and the cost of travel between each pair of them, the problem challenges you to find the cheapest route by which to visit all the cities and return home to where you began. Though seemingly modest, this exercise has inspired studies by mathematicians, chemists, and physicists. Teachers use it in the classroom. It has practical applications in genetics, telecommunications, and neuroscience. The authors of this book are the same pioneers who for nearly two decades have led the investigation into the traveling salesman problem. They have derived solutions to almost eighty-six thousand cities, yet a general solution to the problem has yet to be discovered. Here they describe the method and computer code they used to solve a broad range of large-scale problems, and along the way they demonstrate the interplay of applied mathematics with increasingly powerful computing platforms. They also give the fascinating history of the problem--how it developed, and why it continues to intrigue us.

Organizations and businesses strive toward excellence, and solutions to problems are based mostly on judgment and experience. However, increased competition and consumer demands require that the solutions be optimum and not just feasible. Theory leads to algorithms. Algorithms need to be translated into computer codes. Engineering problems need to be modeled. Optimum solutions are obtained using theory and computers, and then interpreted. Revised and expanded in its third edition, this textbook integrates theory, modeling, development of numerical methods, and problem solving, thus preparing students to apply optimization to real-world problems. This text covers a broad variety of optimization problems using: unconstrained, constrained, gradient, and non-gradient techniques; duality concepts; multi-objective optimization; linear, integer, geometric, and dynamic programming with applications; and finite element-based optimization. It is ideal for advanced undergraduate or graduate courses in optimization design and for practicing engineers.

This text, now in the Third Edition, aims to provide students with a clear, well-structured and comprehensive treatment of the theory and applications of operations research. The methodology used is to first introduce the students to the fundamental concepts through numerical illustrations and then explain the underlying theory, wherever required. Inclusion of case studies in the existing chapters makes learning easier and more effective. The book introduces the readers to various models of Operations Research (OR), such as transportation model, assignment model, inventory models, queueing theory and integer programming models. Various techniques to solve OR problems' faced by managers are also discussed. Separate chapters are devoted to Linear Programming, Dynamic Programming and Quadratic Programming which greatly help in the decision-making process. The text facilitates easy comprehension of topics by the students due to inclusion of: • Examples and situations from the Indian context. • Numerous exercise problems arranged in a graded manner. • A large number of illustrative examples. The text is primarily intended for the postgraduate students of management, computer applications, commerce, mathematics and statistics. Besides, the undergraduate students of mechanical engineering and industrial engineering will find this book extremely useful. In addition, this text can also be used as a reference by OR analysts and operations managers. NEW TO THE THIRD EDITION • Includes two new chapters: – Chapter 14: Project Management—PERT and CPM – Chapter 15: Miscellaneous Topics (Game Theory, Sequencing and Scheduling, Simulation, and Replacement Models) • Incorporates more examples in the existing chapters to illustrate new models, algorithms and concepts • Provides short questions and additional numerical problems for practice in each chapter

This is a textbook devoted to mathematical programming algorithms and the mathematics needed to understand such algorithms. It was mainly written for economists, but the mathematics itself obviously has relevance for other disciplines. It is a textbook as well as a contribution to new knowledge. There is, accordingly, a broad ordering of climbing sophistication, the

earlier chapters being purely for the student, the later chapters being more specialist and containing some element of novelty on certain points. The book is edited in five parts. Part I deals with elementary matrix operations, matrix inversion, determinants, etc. Part II is mainly devoted to linear programming. As far as students' readability is concerned, these two parts are elementary undergraduate material. However, I would claim, in particular with respect to linear programming, that I do things more efficiently than the standard textbook approach has it. This refers mainly to the search for a feasible solution i.e. Chapter 9, and to upper and lower limits, i.e. Chapter 10. I have also argued that the standard textbook treatment of degeneracy misses a relevant problem, namely that of accuracy. In short, I would invite anyone who has the task of writing or designing an LP-code, to first acquaint himself with my ideas. viii INTRODUCTION Parts III and IV are concerned with nonlinear programming.

This textbook provides a self-contained introduction to linear programming using MATLAB software to elucidate the development of algorithms and theory. Early chapters cover linear algebra basics, the simplex method, duality, the solving of large linear problems, sensitivity analysis, and parametric linear programming. In later chapters, the authors discuss quadratic programming, linear complementarity, interior-point methods, and selected applications of linear programming to approximation and classification problems. Exercises are interwoven with the theory presented in each chapter, and two appendices provide additional information on linear algebra, convexity, nonlinear functions, and on available MATLAB commands, respectively. Readers can access MATLAB codes and associated mex files at a Web site maintained by the authors. Only a basic knowledge of linear algebra and calculus is required to understand this textbook, which is geared toward junior and senior-level undergraduate students, first-year graduate students, and researchers unfamiliar with linear programming.

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