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## **Textbook: Introduction to Linear Optimization**

Course text: Introduction to Linear Optimization by Dimitris Bertsimas and John N. Tsitsiklis, Athena Scientific 1997. Syllabus: We plan to study topics from the following chapters in the text book: 1. Introduction 2. Geometry of Linear Programming 3. The Simplex Method 4. Duality Theory 5. Sensitivity Analysis 7. Complexity and the Ellipsoid Method 8.

## **Introduction to Optimization Spring 2017**

Introduction to Linear Optimization. Co-author: John Tsitsiklis Dynamic Ideas and Athena Scientific, Belmont, Massachusetts, March, 2008. The book is a modern and unified introduction to linear optimization (linear programming, network flows and integer programming) at the PhD level.

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Introduction to Linear Optimization . 1997.  
Abstract. No abstract available. ...

Bertsimas D and Vempala S Solving convex programs by random walks Proceedings of the thirty-fourth annual ACM symposium on Theory of computing, (109-115) Engelke S and Kanzow C (2019) ...

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".

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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

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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.

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

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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;
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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

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 encyclopedic resource for such formulations, as well as for understanding the structure of and solving 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

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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.

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

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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.

"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.

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