

# Alexander Schrijver A Course In Combinatorial Optimization

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**Semidefinite Optimization and Convex Algebraic Geometry** - Grigoriy Blekherman 2013-03-21

An accessible introduction to convex algebraic geometry and semidefinite optimization. For graduate students and researchers in mathematics and computer science.

**The Baptist Heritage** - H. Leon McBeth 1987-01-29

The Baptist Heritage: Four Century of Baptist Witness H. Leon McBeth's 'The Baptist heritage' is a definitive, fresh interpretation of Baptist history. Based on primary source research, the book combines the best features of chronological and topical history to bring alive the story of Baptists around the world.

**Introduction to the Theory of Matroids** - R. Rado 2012-12-06

Matroid theory has its origin in a paper by H. Whitney entitled "On the abstract properties of linear dependence" [35], which appeared in 1935. The main objective of the paper was to establish the essential (abstract) properties of the concepts of linear dependence and independence in vector spaces, and to use these for the axiomatic definition of a new algebraic object, namely the matroid. Furthermore, Whitney showed that these axioms are also abstractions of certain graph-theoretic concepts. This is very much in evidence when one considers the basic concepts making up the structure of a matroid: some reflect their linear algebraic origin, while others reflect their graph-theoretic origin. Whitney also studied a number of important examples of matroids. The next major development was brought about in the forties by R. Rado's matroid generalisation of P. Hall's famous "marriage" theorem. This provided new impulses for transversal theory, in which matroids today play an essential role under the name of "independence structures", cf. the treatise on transversal theory by L. Mirsky [26]. At roughly the same time R.P. Dilworth established the connection between matroids and lattice theory. Thus matroids became an essential part of combinatorial mathematics. About ten years later W.T. Tutte [30] developed the fundamentals of matroids in detail from a graph-theoretic point of view, and characterised graphic matroids as well as the larger class of those matroids that are representable over any field.

**The Design of Competitive Online Algorithms Via a Primal-Dual Approach** - Niv Buchbinder 2009

Extends the primal-dual method to the setting of online algorithms, and shows its applicability to a wide variety of fundamental problems.

**Facets of Combinatorial Optimization** - Michael Jünger 2013-07-03

Martin Grötschel is one of the most influential mathematicians of our time. He has received numerous honors and holds a number of key positions in the international mathematical community. He celebrated his 65th birthday on September 10, 2013. Martin Grötschel's doctoral descendant tree 1983-2012, i.e., the first 30 years, features 39 children, 74 grandchildren, 24 great-grandchildren and 2 great-great-grandchildren, a total of 139 doctoral descendants. This book starts with a personal tribute to Martin Grötschel by the editors (Part I), a contribution by his very special "predecessor" Manfred Padberg on "Facets and Rank of Integer Polyhedra" (Part II), and the doctoral descendant tree 1983-2012 (Part III). The core of this book (Part IV) contains 16 contributions, each of which is coauthored by at least one doctoral descendant. The sequence of the articles starts with contributions to the theory of mathematical optimization, including polyhedral combinatorics, extended formulations, mixed-integer convex optimization, super classes of perfect graphs, efficient algorithms for subtree-telecenters, junctions in acyclic graphs and preemptive

restricted strip covering, as well as efficient approximation of non-preemptive restricted strip covering.

Combinations of new theoretical insights with algorithms and experiments deal with network design problems, combinatorial optimization problems with submodular objective functions and more general mixed-integer nonlinear optimization problems. Applications include VLSI layout design, systems biology, wireless network design, mean-risk optimization and gas network optimization. Computational studies include a semidefinite branch and cut approach for the max k-cut problem, mixed-integer nonlinear optimal control, and mixed-integer linear optimization for scheduling and routing of fly-in safari planes. The two closing articles are devoted to computational advances in general mixed integer linear optimization, the first by scientists working in industry, the second by scientists working in academia. These articles reflect the "scientific facets" of Martin Grötschel who has set standards in theory, computation and applications.

**Graphs, Networks and Algorithms** - Dieter Jungnickel 2013-06-29

Revised throughout Includes new chapters on the network simplex algorithm and a section on the five color theorem Recent developments are discussed

**Column Generation** - Guy Desaulniers 2006-03-20

Column Generation is an insightful overview of the state of the art in integer programming column generation and its many applications. The volume begins with "A Primer in Column Generation" which outlines the theory and ideas necessary to solve large-scale practical problems, illustrated with a variety of examples. Other chapters follow this introduction on "Shortest Path Problems with Resource Constraints," "Vehicle Routing Problem with Time Window," "Branch-and-Price Heuristics," "Cutting Stock Problems," each dealing with methodological aspects of the field. Three chapters deal with transportation applications: "Large-scale Models in the Airline Industry," "Robust Inventory Ship Routing by Column Generation," and "Ship Scheduling with Recurring Visits and Visit Separation Requirements." Production is the focus of another three chapters: "Combining Column Generation and Lagrangian Relaxation," "Dantzig-Wolfe Decomposition for Job Shop Scheduling," and "Applying Column Generation to Machine Scheduling." The final chapter by François Vanderbeck, "Implementing Mixed Integer Column Generation," reviews how to set-up the Dantzig-Wolfe reformulation, adapt standard MIP techniques to the column generation context (branching, preprocessing, primal heuristics), and deal with specific column generation issues (initialization, stabilization, column management strategies).

**Algorithms for Convex Optimization** - S. S. Venkatesh K. Vishnoi 2021-09-30

In the last few years, Algorithms for Convex Optimization have revolutionized algorithm design, both for discrete and continuous optimization problems. For problems like maximum flow, maximum matching, and submodular function minimization, the fastest algorithms involve essential methods such as gradient descent, mirror descent, interior point methods, and ellipsoid methods. The goal of this self-contained book is to enable researchers and professionals in computer science, data science, and machine learning to gain an in-depth understanding of these algorithms. The text emphasizes how to derive key algorithms for convex optimization from first principles and how to establish precise running time bounds. This modern text explains the success of these algorithms in problems of discrete optimization, as well as how these methods have significantly pushed the state of the art of convex optimization itself.

Linear Inequalities and Related Systems - George Bernard Dantzig 1956-10-21

The description for this book, Linear Inequalities and Related Systems. (AM-38), Volume 38, will be forthcoming.

Geometric Algorithms and Combinatorial Optimization - Martin Grötschel 2012-12-06

Since the publication of the first edition of our book, geometric algorithms and combinatorial optimization have kept growing at the same fast pace as before. Nevertheless, we do not feel that the ongoing research has made this book outdated. Rather, it seems that many of the new results build on the models, algorithms, and theorems presented here. For instance, the celebrated Dyer-Frieze-Kannan algorithm for approximating the volume of a convex body is based on the oracle model of convex bodies and uses the ellipsoid method as a preprocessing technique. The polynomial time equivalence of optimization, separation, and membership has become a commonly employed tool in the study of the complexity of combinatorial optimization problems and in the newly developing field of computational convexity. Implementations of the basis reduction algorithm can be found in various computer algebra software systems. On the other hand, several of the open problems discussed in the first edition are still unsolved. For example, there are still no combinatorial polynomial time algorithms known for minimizing a submodular function or finding a maximum clique in a perfect graph. Moreover, despite the success of the interior point methods for the solution of explicitly given linear programs there is still no method known that solves implicitly given linear programs, such as those described in this book, and that is both practically and theoretically efficient. In particular, it is not known how to adapt interior point methods to such linear programs.

**Approximation Algorithms and Semidefinite Programming** - Bernd Gärtner 2012-01-10

Semidefinite programs constitute one of the largest classes of optimization problems that can be solved with reasonable efficiency - both in theory and practice. They play a key role in a variety of research areas, such as combinatorial optimization, approximation algorithms, computational complexity, graph theory, geometry, real algebraic geometry and quantum computing. This book is an introduction to selected aspects of semidefinite programming and its use in approximation algorithms. It covers the basics but also a significant amount of recent and more advanced material. There are many computational problems, such as MAXCUT, for which one cannot reasonably expect to obtain an exact solution efficiently, and in such case, one has to settle for approximate solutions. For MAXCUT and its relatives, exciting recent results suggest that semidefinite programming is probably the ultimate tool. Indeed, assuming the Unique Games Conjecture, a plausible but as yet unproven hypothesis, it was shown that for these problems, known algorithms based on semidefinite programming deliver the best possible approximation ratios among all polynomial-time algorithms. This book follows the "semidefinite side" of these developments, presenting some of the main ideas behind approximation algorithms based on semidefinite programming. It develops the basic theory of semidefinite programming, presents one of the known efficient algorithms in detail, and describes the principles of some others. It also includes applications, focusing on approximation algorithms.

Lectures on Modern Convex Optimization - Aharon Ben-Tal 2001-01-01

Here is a book devoted to well-structured and thus efficiently solvable convex optimization problems, with emphasis on conic quadratic and semidefinite programming. The authors present the basic theory underlying these problems as well as their numerous applications in engineering, including synthesis of filters, Lyapunov stability analysis, and structural design. The authors also discuss the complexity issues and provide an overview of the basic theory of state-of-the-art polynomial time interior point methods for linear, conic quadratic, and semidefinite programming. The book's focus on well-structured convex problems in conic form allows for unified theoretical and algorithmical treatment of a wide spectrum of important optimization problems arising in applications.

**Partitions of Mass-distributions and of Convex Bodies by Hyperplanes** - B. Grunbaum 1960

**Handbooks in Operations Research and Management Science** - K. Aardal 2005-12-08

The chapters of this Handbook volume cover nine main topics that are representative of recent theoretical and algorithmic developments in the field. In addition to the nine papers that present the state of the art, there is an article on the early history of the field. The handbook will be a useful reference to experts in the

field as well as students and others who want to learn about discrete optimization.

**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.

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.

The Probabilistic Method - Noga Alon 2016-01-26

Praise for the Third Edition "Researchers of any kind of extremal combinatorics or theoretical computer science will welcome the new edition of this book." - MAA Reviews Maintaining a standard of excellence that establishes The Probabilistic Method as the leading reference on probabilistic methods in combinatorics, the Fourth Edition continues to feature a clear writing style, illustrative examples, and illuminating exercises. The new edition includes numerous updates to reflect the most recent developments and advances in discrete mathematics and the connections to other areas in mathematics, theoretical computer science, and statistical physics. Emphasizing the methodology and techniques that enable problem-solving, The Probabilistic Method, Fourth Edition begins with a description of tools applied to probabilistic arguments, including basic techniques that use expectation and variance as well as the more advanced applications of martingales and correlation inequalities. The authors explore where probabilistic techniques have been applied successfully and also examine topical coverage such as discrepancy and random graphs, circuit complexity, computational geometry, and derandomization of randomized algorithms. Written by two well-known authorities in the field, the Fourth Edition features: Additional exercises throughout with hints and solutions to select problems in an appendix to help readers obtain a deeper understanding of the best methods and techniques New coverage on topics such as the Local Lemma, Six Standard Deviations result in Discrepancy Theory, Property B, and graph limits Updated sections to reflect major developments on the newest topics, discussions of the hypergraph container method, and many new references and improved results The Probabilistic Method, Fourth Edition is an ideal textbook for upper-undergraduate and graduate-level students majoring in mathematics, computer science, operations research, and statistics. The Fourth Edition is also an excellent reference for researchers and combinatorists who use probabilistic methods, discrete mathematics, and number theory. Noga Alon, PhD, is Baumritter Professor of Mathematics and Computer Science at Tel Aviv University. He is a member of the Israel National Academy of Sciences and Academia Europaea. A coeditor of the journal Random Structures and Algorithms, Dr. Alon is the recipient of the Polya Prize, The Gödel Prize, The Israel Prize, and the EMET Prize. Joel H. Spencer, PhD, is Professor of Mathematics and Computer Science at the Courant Institute of New York University. He is the cofounder and coeditor of the journal Random Structures and Algorithms and is a Sloane Foundation Fellow. Dr. Spencer has written more than 200

published articles and is the coauthor of Ramsey Theory, Second Edition, also published by Wiley.

Handbook of Approximation Algorithms and Metaheuristics - Teofilo F. Gonzalez 2018-05-15

Handbook of Approximation Algorithms and Metaheuristics, Second Edition reflects the tremendous growth in the field, over the past two decades. Through contributions from leading experts, this handbook provides a comprehensive introduction to the underlying theory and methodologies, as well as the various applications of approximation algorithms and metaheuristics. Volume 1 of this two-volume set deals primarily with methodologies and traditional applications. It includes restriction, relaxation, local ratio, approximation schemes, randomization, tabu search, evolutionary computation, local search, neural networks, and other metaheuristics. It also explores multi-objective optimization, reoptimization, sensitivity analysis, and stability. Traditional applications covered include: bin packing, multi-dimensional packing, Steiner trees, traveling salesperson, scheduling, and related problems. Volume 2 focuses on the contemporary and emerging applications of methodologies to problems in combinatorial optimization, computational geometry and graphs problems, as well as in large-scale and emerging application areas. It includes approximation algorithms and heuristics for clustering, networks (sensor and wireless), communication, bioinformatics search, streams, virtual communities, and more. About the Editor Teofilo F. Gonzalez is a professor emeritus of computer science at the University of California, Santa Barbara. He completed his Ph.D. in 1975 from the University of Minnesota. He taught at the University of Oklahoma, the Pennsylvania State University, and the University of Texas at Dallas, before joining the UCSB computer science faculty in 1984. He spent sabbatical leaves at the Monterrey Institute of Technology and Higher Education and Utrecht University. He is known for his highly cited pioneering research in the hardness of approximation; for his sublinear and best possible approximation algorithm for k-tMM clustering; for introducing the open-shop scheduling problem as well as algorithms for its solution that have found applications in numerous research areas; as well as for his research on problems in the areas of job scheduling, graph algorithms, computational geometry, message communication, wire routing, etc.

*Topi cs i n Conbi natorial Opt i mi zat i on* Rinaldi 1980-12-31

In recent years, the need for a review of the state of the art in Combinatorial Optimization has been felt by many scientists and researchers in the field. The opportunity of achieving this aim was offered by the Deputy Secretary General of the International Centre of Mechanical Sciences, Professor A. Marzollo, who invited the contributors of this volume to Udine for a Workshop. During the meeting the participants discussed their results and their ideas on the future developments of the various facets of this expanding area of applied mathematics. The success of the Workshop and the encouragement of the participants suggested that I collect the main contributions in the present volume. It is my hope that it may both give a sound background to people entering this fascinating area of study and stimulate further research in the field. The Editor Sergio Rinaldi LIST OF CONTRIBUTORS BARTHES, J. P. : Departement d'informatique et de Mathematiques Appli quees - Universite de Technologie de Compiegne - 60200 Compiegne, France.

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**Lectures on Polytopes** - Günter M. Ziegler 2012-05-03

Based on a graduate course at the Technische Universität, Berlin, these lectures present a wealth of material on the modern theory of convex polytopes. The straightforward exposition features many illustrations, and complete proofs for most theorems. With only linear algebra as a prerequisite, it takes the reader quickly from the basics to topics of recent research. The lectures introduce basic facts about polytopes, with an emphasis on methods that yield the results, discuss important examples and elegant constructions, and show the excitement of current work in the field. They will provide interesting and enjoyable reading for researchers as well as students.

**Iterative Methods in Combinatorial Optimization** - Lap Chi Lau 2011-04-18

With the advent of approximation algorithms for NP-hard combinatorial optimization problems, several techniques from exact optimization such as the primal-dual method have proven their staying power and versatility. This book describes a simple and powerful method that is iterative in essence and similarly

useful in a variety of settings for exact and approximate optimization. The authors highlight the commonality and uses of this method to prove a variety of classical polyhedral results on matchings, trees, matroids and flows. The presentation style is elementary enough to be accessible to anyone with exposure to basic linear algebra and graph theory, making the book suitable for introductory courses in combinatorial optimization at the upper undergraduate and beginning graduate levels. Discussions of advanced applications illustrate their potential for future application in research in approximation algorithms.

**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

Optimization Over Integers - Dimitris Bertsimas 2005

**Combinatorial Optimization** - William J. Cook 2011-09-30

A complete, highly accessible introduction to one of today's most exciting areas of applied mathematics One of the youngest, most vital areas of applied mathematics, combinatorial optimization integrates techniques from combinatorics, linear programming, and the theory of algorithms. Because of its success in solving difficult problems in areas from telecommunications to VLSI, from product distribution to airline crew scheduling, the field has seen a ground swell of activity over the past decade. Combinatorial Optimization is an ideal introduction to this mathematical discipline for advanced undergraduates and graduate students of discrete mathematics, computer science, and operations research. Written by a team of recognized experts, the text offers a thorough, highly accessible treatment of both classical concepts and recent results. The topics include: \* Network flow problems \* Optimal matching \* Integrality of polyhedra \* Matroids \* NP-completeness Featuring logical and consistent exposition, clear explanations of basic and advanced concepts, many real-world examples, and helpful, skill-building exercises, Combinatorial Optimization is certain to become the standard text in the field for many years to come.

*CATBox* - Winfried Hochstättler 2010-03-16

Graph algorithms are easy to visualize and indeed there already exists a variety of packages to animate the dynamics when solving problems from graph theory. Still it can be difficult to understand the ideas behind the algorithm from the dynamic display alone. CATBox consists of a software system for animating graph algorithms and a course book which we developed simultaneously. The software system presents both the algorithm and the graph and puts the user always in control of the actual code that is executed. In the course book, intended for readers at advanced undergraduate or graduate level, computer exercises and

examples replace the usual static pictures of algorithm dynamics. For this volume we have chosen solely algorithms for classical problems from combinatorial optimization, such as minimum spanning trees, shortest paths, maximum flows, minimum cost flows, weighted and unweighted matchings both for bipartite and non-bipartite graphs. Find more information at <http://schliep.org/CATBox/>.

**Ant Colony Optimization** - Marco Dorigo 2004-06-04

An overview of the rapidly growing field of ant colony optimization that describes theoretical findings, the major algorithms, and current applications. The complex social behaviors of ants have been much studied by science, and computer scientists are now finding that these behavior patterns can provide models for solving difficult combinatorial optimization problems. The attempt to develop algorithms inspired by one aspect of ant behavior, the ability to find what computer scientists would call shortest paths, has become the field of ant colony optimization (ACO), the most successful and widely recognized algorithmic technique based on ant behavior. This book presents an overview of this rapidly growing field, from its theoretical inception to practical applications, including descriptions of many available ACO algorithms and their uses. The book first describes the translation of observed ant behavior into working optimization algorithms. The ant colony metaheuristic is then introduced and viewed in the general context of combinatorial optimization. This is followed by a detailed description and guide to all major ACO algorithms and a report on current theoretical findings. The book surveys ACO applications now in use, including routing, assignment, scheduling, subset, machine learning, and bioinformatics problems. AntNet, an ACO algorithm designed for the network routing problem, is described in detail. The authors conclude by summarizing the progress in the field and outlining future research directions. Each chapter ends with bibliographic material, bullet points setting out important ideas covered in the chapter, and exercises. Ant Colony Optimization will be of interest to academic and industry researchers, graduate students, and practitioners who wish to learn how to implement ACO algorithms.

**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".

**Multiagent Systems** - Gerhard Weiss 2013-03-08

This is the first comprehensive introduction to multiagent systems and contemporary distributed artificial intelligence that is suitable as a textbook.

**Digraphs** - Jorgen Bang-Jensen 2013-06-29

The study of directed graphs (digraphs) has developed enormously over recent decades, yet the results are rather scattered across the journal literature. This is the first book to present a unified and comprehensive survey of the subject. In addition to covering the theoretical aspects, the authors discuss a large number of applications and their generalizations to topics such as the traveling salesman problem, project scheduling, genetics, network connectivity, and sparse matrices. Numerous exercises are included. For all graduate students, researchers and professionals interested in graph theory and its applications, this book will be essential reading.

**Mathematics and Computation** - Avi Wigderson 2019-10-29

An introduction to computational complexity theory, its connections and interactions with mathematics, and its central role in the natural and social sciences, technology, and philosophy. Mathematics and Computation provides a broad, conceptual overview of computational complexity theory—the mathematical study of efficient computation. With important practical applications to computer science and industry, computational complexity theory has evolved into a highly interdisciplinary field, with strong links to most mathematical areas and to a growing number of scientific endeavors. Avi Wigderson takes a sweeping survey of complexity theory, emphasizing the field's insights and challenges. He explains the ideas and motivations leading to key models, notions, and results. In particular, he looks at algorithms and

complexity, computations and proofs, randomness and interaction, quantum and arithmetic computation, and cryptography and learning, all as parts of a cohesive whole with numerous cross-influences. Wigderson illustrates the immense breadth of the field, its beauty and richness, and its diverse and growing interactions with other areas of mathematics. He ends with a comprehensive look at the theory of computation, its methodology and aspirations, and the unique and fundamental ways in which it has shaped and will further shape science, technology, and society. For further reading, an extensive bibliography is provided for all topics covered. Mathematics and Computation is useful for undergraduate and graduate students in mathematics, computer science, and related fields, as well as researchers and teachers in these fields. Many parts require little background, and serve as an invitation to newcomers seeking an introduction to the theory of computation. Comprehensive coverage of computational complexity theory, and beyond High-level, intuitive exposition, which brings conceptual clarity to this central and dynamic scientific discipline. Historical accounts of the evolution and motivations of central concepts and models. A broad view of the theory of computation's influence on science, technology, and society. Extensive bibliography.

**The LLL Algorithm** - Phong Q. Nguyen 2009-12-02

The first book to offer a comprehensive view of the LLL algorithm, this text surveys computational aspects of Euclidean lattices and their main applications. It includes many detailed motivations, explanations and examples.

**Geometric Algorithms and Combinatorial Optimization** - Martin Grötschel 2012-12-06

Historically, there is a close connection between geometry and optimization. This is illustrated by methods like the gradient method and the simplex method, which are associated with clear geometric pictures. In combinatorial optimization, however, many of the strongest and most frequently used algorithms are based on the discrete structure of the problems: the greedy algorithm, shortest path and alternating path methods, branch-and-bound, etc. In the last several years geometric methods, in particular polyhedral combinatorics, have played a more and more profound role in combinatorial optimization as well. Our book discusses two recent geometric algorithms that have turned out to have particularly interesting consequences in combinatorial optimization, at least from a theoretical point of view. These algorithms are able to utilize the rich body of results in polyhedral combinatorics. The first of these algorithms is the ellipsoid method, developed for nonlinear programming by N. Z. Shor, D. B. Yudin, and A. S. Nemirovskii. It was a great surprise when L. G. Khachiyan showed that this method can be adapted to solve linear programs in polynomial time, thus solving an important open theoretical problem. While the ellipsoid method has not proved to be competitive with the simplex method in practice, it does have some features which make it particularly suited for the purposes of combinatorial optimization. The second algorithm we discuss finds its roots in the classical "geometry of numbers", developed by Minkowski. This method has had traditionally deep applications in number theory, in particular in diophantine approximation.

**Convex Optimization** - Stephen Boyd 2004-03-08

A comprehensive introduction to the tools, techniques and applications of convex optimization.

**New Optimization Algorithms in Physics** - Alexander K. Hartmann 2006-03-06

Many physicists are not aware of the fact that they can solve their problems by applying optimization algorithms. Since the number of such algorithms is steadily increasing, many new algorithms have not been presented comprehensively until now. This presentation of recently developed algorithms applied in physics, including demonstrations of how they work and related results, aims to encourage their application, and as such the algorithms selected cover concepts and methods from statistical physics to optimization problems emerging in theoretical computer science.

**Combinatorial Optimization** - Bernhard Korte 2006-01-27

This well-written textbook on combinatorial optimization puts special emphasis on theoretical results and algorithms with provably good performance, in contrast to heuristics. The book contains complete (but concise) proofs, as well as many deep results, some of which have not appeared in any previous books.

**Graph Theory with Applications** - John Adrian Bondy 1976

**Twenty Lectures on Algorithmic Game Theory** - Tim Roughgarden 2016-08-30

Computer science and economics have engaged in a lively interaction over the past fifteen years, resulting in the new field of algorithmic game theory. Many problems that are central to modern computer science, ranging from resource allocation in large networks to online advertising, involve interactions between multiple self-interested parties. Economics and game theory offer a host of useful models and definitions to reason about such problems. The flow of ideas also travels in the other direction, and concepts from computer science are increasingly important in economics. This book grew out of the author's Stanford University course on algorithmic game theory, and aims to give students and other newcomers a quick and accessible introduction to many of the most important concepts in the field. The book also includes case studies on online advertising, wireless spectrum auctions, kidney exchange, and network management.

**Combinatorial Optimization** - Bernhard Korte 2013-11-11

This well-written textbook on combinatorial optimization puts special emphasis on theoretical results and algorithms with provably good performance, in contrast to heuristics. The book contains complete (but concise) proofs, as well as many deep results, some of which have not appeared in any previous books.

Pattern Recognition Applications and Methods - Ana Fred 2017-02-08

This book contains revised and extended versions of selected papers from the 5th International Conference on Pattern Recognition, ICPRAM 2016, held in Rome, Italy, in February 2016. The 13 full papers were carefully reviewed and selected from 125 initial submissions and describe up-to-date applications of pattern recognition techniques to real-world problems, interdisciplinary research, experimental and/or theoretical studies yielding new insights that advance pattern recognition methods.

Handbook on Modelling for Discrete Optimization - Guntam M. Appa 2006-08-18

This book aims to demonstrate and detail the pervasive nature of Discrete Optimization. The handbook couples the difficult, critical-thinking aspects of mathematical modeling with the hot area of discrete optimization. It is done with an academic treatment outlining the state-of-the-art for researchers across the domains of the Computer Science, Math Programming, Applied Mathematics, Engineering, and Operations Research. The book utilizes the tools of mathematical modeling, optimization, and integer programming to solve a broad range of modern problems.