

Complexity And Approximation Combinatorial Optimization Problems And Their Approximability Properties

This book constitutes the joint refereed proceedings of the 11th International Workshop on Approximation Algorithms for Combinatorial Optimization Problems, APPROX 2008 and the 12th International Workshop on Randomization and Computation, RANDOM 2008, held in Boston, MA, USA, in August 2008. The 20 revised full papers of the APPROX 2008 workshop were carefully reviewed and selected from 42 submissions and focus on algorithmic and complexity issues surrounding the development of efficient approximate solutions to computationally difficult problems. RANDOM 2008 is concerned with applications of randomness to computational and combinatorial problems and accounts for 27 revised full papers, also diligently reviewed and selected out of 52 workshop submissions.

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.

The fusion between graph theory and combinatorial optimization has led to theoretically profound and practically useful algorithms, yet there is no book that currently covers both areas together. Handbook of Graph Theory, Combinatorial Optimization, and Algorithms is the first to present a unified, comprehensive treatment of both graph theory and c

This is the first book to fully address the study of approximation algorithms as a tool for coping with intractable problems. With chapters contributed by leading researchers in the field, this book introduces unifying techniques in the analysis of approximation algorithms. APPROXIMATION ALGORITHMS FOR NP-HARD PROBLEMS is intended for computer scientists and operations researchers interested in specific algorithm implementations, as well as design tools for algorithms. Among the techniques discussed: the use of linear programming, primal-dual techniques in worst-case

Read Online Complexity And Approximation Combinatorial Optimization Problems And Their Approximability Properties

analysis, semidefinite programming, computational geometry techniques, randomized algorithms, average-case analysis, probabilistically checkable proofs and inapproximability, and the Markov Chain Monte Carlo method. The text includes a variety of pedagogical features: definitions, exercises, open problems, glossary of problems, index, and notes on how best to use the book.

Computational complexity, originated from the interactions between computer science and numerical optimization, is one of the major theories that have revolutionized the approach to solving optimization problems and to analyzing their intrinsic difficulty. The main focus of complexity is the study of whether existing algorithms are efficient for the solution of problems, and which problems are likely to be tractable. The quest for developing efficient algorithms leads also to elegant general approaches for solving optimization problems, and reveals surprising connections among problems and their solutions. This book is a collection of articles on recent complexity developments in numerical optimization. The topics covered include complexity of approximation algorithms, new polynomial time algorithms for convex quadratic minimization, interior point algorithms, complexity issues regarding test generation of NP-hard problems, complexity of scheduling problems, min-max, fractional combinatorial optimization, fixed point computations and network flow problems. The collection of articles provide a broad spectrum of the direction in which research is going and help to elucidate the nature of computational complexity in optimization. The book will be a valuable source of information to faculty, students and researchers in numerical optimization and related areas.

Bioinspired computation methods such as evolutionary algorithms and ant colony optimization are being applied successfully to complex engineering problems and to problems from combinatorial optimization, and with this comes the requirement to more fully understand the computational complexity of these search heuristics. This is the first textbook covering the most important results achieved in this area. The authors study the computational complexity of bioinspired computation and show how runtime behavior can be analyzed in a rigorous way using some of the best-known combinatorial optimization problems -- minimum spanning trees, shortest paths, maximum matching, covering and scheduling problems. A feature of the book is the separate treatment of single- and multiobjective problems, the latter a domain where the development of the underlying theory seems to be lagging practical successes. This book will be very valuable for teaching courses on bioinspired computation and combinatorial optimization. Researchers will also benefit as the presentation of the theory covers the most important developments in the field over the last 10 years.

Finally, with a focus on well-studied combinatorial optimization problems rather than toy problems, the book will also be very valuable for practitioners in this field.

This is the joint refereed proceedings of the 9th International Workshop on Approximation Algorithms for Combinatorial Optimization Problems, APPROX 2006 and the 10th International Workshop on Randomization and Computation, RANDOM 2006.

The book presents 44 carefully reviewed and revised full papers. Among the topics covered are design and analysis of approximation algorithms, hardness of approximation problems, small spaces and data streaming algorithms, embeddings and metric space methods, and more.

This book constitutes the refereed proceedings of the Third International Workshop on

Read Online Complexity And Approximation Combinatorial Optimization Problems And Their Approximability Properties

Approximation Algorithms for Combinatorial Optimization Problems, APPROX 2000, held in Saarbrücken, Germany in September 2000. The 22 revised full papers presented together with four invited contributions were carefully reviewed and selected from 68 submissions. The topics dealt with include design and analysis of approximation algorithms, inapproximability results, on-line problems, randomization techniques, average-case analysis, approximation classes, scheduling problems, routing and flow problems, coloring and partitioning, cuts and connectivity, packing and covering, geometric problems, network design, and various applications.

This volume presents the refereed proceedings of the 10th International Workshop on Approximation Algorithms for Combinatorial Optimization Problems and the 11th International Workshop on Randomization and Computation. The papers cover design and analysis of approximation algorithms, hardness of approximation, small space and data streaming algorithms, sub-linear time algorithms, embeddings and metric space methods, and much more.

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. The book focuses on the next fields of computer science: combinatorial optimization, scheduling theory, decision theory, and computer-aided production management systems. It also offers a quick introduction into the theory of PSC-algorithms, which are a new class of efficient methods for intractable problems of combinatorial optimization. A PSC-algorithm is an algorithm which includes: sufficient conditions of a feasible solution optimality for which their checking can be implemented only at the stage of a feasible solution construction, and this construction is carried out by a polynomial algorithm (the first polynomial component of the PSC-algorithm); an approximation algorithm with polynomial complexity (the second polynomial component of the PSC-algorithm); also, for NP-hard combinatorial optimization problems, an exact subalgorithm if sufficient conditions were found, fulfilment of which during the algorithm execution turns it into a polynomial complexity algorithm. Practitioners and software developers will find the book useful for implementing advanced methods of production organization in the fields of planning (including operative planning) and decision making. Scientists, graduate and master students, or system engineers who are interested in problems of combinatorial optimization, decision making with poorly formalized overall goals, or a multiple regression construction will benefit from this book.

Combinatorial optimization is a multidisciplinary scientific area, lying in the interface of three major scientific domains: mathematics, theoretical computer science and management. The three volumes of the Combinatorial Optimization series aims to cover

Read Online Complexity And Approximation Combinatorial Optimization Problems And Their Approximability Properties

a wide range of topics in this area. These topics also deal with fundamental notions and approaches as with several classical applications of combinatorial optimization. Concepts of Combinatorial Optimization, is divided into three parts: On the complexity of combinatorial optimization problems, that presents basics about worst-case and randomized complexity; Classical solution methods, that presents the two most-known methods for solving hard combinatorial optimization problems, that are Branch-and-Bound and Dynamic Programming; Elements from mathematical programming, that presents fundamentals from mathematical programming based methods that are in the heart of Operations Research since the origins of this field.

This Festschrift is in honor of Ker-I Ko, Professor in the Stony Brook University, USA. Ker-I Ko was one of the founding fathers of computational complexity over real numbers and analysis. He and Harvey Friedman devised a theoretical model for real number computations by extending the computation of Turing machines. He contributed significantly to advancing the theory of structural complexity, especially on polynomial-time isomorphism, instance complexity, and relativization of polynomial-time hierarchy. Ker-I also made many contributions to approximation algorithm theory of combinatorial optimization problems. This volume contains 17 contributions in the area of complexity and approximation. Those articles are authored by researchers over the world, including North America, Europe and Asia. Most of them are co-authors, colleagues, friends, and students of Ker-I Ko.

This book documents the state of the art in combinatorial optimization, presenting approximate solutions of virtually all relevant classes of NP-hard optimization problems. The wealth of problems, algorithms, results, and techniques make it an indispensable source of reference for professionals. The text smoothly integrates numerous illustrations, examples, and exercises.

This book constitutes the joint refereed proceedings of the 14th International Workshop on Approximation Algorithms for Combinatorial Optimization Problems, APPROX 2011, and the 15th International Workshop on Randomization and Computation, RANDOM 2011, held in Princeton, New Jersey, USA, in August 2011. The volume presents 29 revised full papers of the APPROX 2011 workshop, selected from 66 submissions, and 29 revised full papers of the RANDOM 2011 workshop, selected from 64 submissions. They were carefully reviewed and selected for inclusion in the book. In addition two abstracts of invited talks are included. APPROX focuses on algorithmic and complexity issues surrounding the development of efficient approximate solutions to computationally difficult problems. RANDOM is concerned with applications of randomness to computational and combinatorial problems.

This volume constitutes the proceedings of the 14th International Conference on Combinatorial Optimization and Applications, COCOA 2020, held in Dallas, TX, USA, in December 2020. The 55 full papers presented in this volume were carefully reviewed and selected from 104 submissions. The papers are grouped into the following topics: Approximation Algorithms; Scheduling; Network Optimization; Complexity and Logic; Search, Facility and Graphs; Geometric Problem; Sensors, Vehicles and Graphs; and Graph Problems. Due to the Corona pandemic this event was held virtually.

This volume contains the papers presented at the 8th International Workshop on Approximation Algorithms for Combinatorial Optimization Problems (APPROX 2005) and the 9th International Workshop on Randomization and Computation (RANDOM

Read Online Complexity And Approximation Combinatorial Optimization Problems And Their Approximability Properties

2005), which took place concurrently at the University of California in Berkeley, on August 22 –24, 2005.

This book constitutes the joint refereed proceedings of the 6th International Workshop on Approximation Algorithms for Optimization Problems, APPROX 2003 and of the 7th International Workshop on Randomization and Approximation Techniques in Computer Science, RANDOM 2003, held in Princeton, NY, USA in August 2003. The 33 revised full papers presented were carefully reviewed and selected from 74 submissions.

Among the issues addressed are design and analysis of randomized and approximation algorithms, online algorithms, complexity theory, combinatorial structures, error-correcting codes, pseudorandomness, derandomization, network algorithms, random walks, Markov chains, probabilistic proof systems, computational learning, randomness in cryptography, and various applications.

Now fully updated in a third edition, this is a comprehensive textbook on combinatorial optimization. It puts special emphasis on theoretical results and algorithms with provably good performance, in contrast to heuristics. The book contains complete but concise proofs, also for many deep results, some of which have not appeared in print before. Recent topics are covered as well, and numerous references are provided. This third edition contains a new chapter on facility location problems, an area which has been extremely active in the past few years. Furthermore there are several new sections and further material on various topics. New exercises and updates in the bibliography were added.

This book contains the contributions to the 31st Hemophilia Symposium, 2000. The main topics are epidemiology, inhibitors in hemophilia, therapy and monitoring of bleeds in acute and intensive care medicine, and pediatric hemostasiology. The volume is rounded off by numerous free papers and posters on hemophilia, hemorrhagic diathesis, thrombophilic diathesis and associated topics.

An introduction to the methods of designing algorithms for hard computing tasks, concentrating mainly on approximate, randomized, and heuristic algorithms, and on the theoretical and experimental comparison of these approaches according to the requirements of the practice. This is the first book to systematically explain and compare all the main possibilities of attacking hard computing problems. It also closes the gap between theory and practice by providing at once a graduate textbook and a handbook for practitioners dealing with hard computing problems.

Nonlinear Assignment Problems (NAPs) are natural extensions of the classic Linear Assignment Problem, and despite the efforts of many researchers over the past three decades, they still remain some of the hardest combinatorial optimization problems to solve exactly. The purpose of this book is to provide in a single volume, major algorithmic aspects and applications of NAPs as contributed by leading international experts. The chapters included in this book are concerned with major applications and the latest algorithmic solution approaches for NAPs. Approximation algorithms, polyhedral methods, semidefinite programming approaches and heuristic procedures for NAPs are included, while applications of this problem class in the areas of multiple-target tracking in the context of military surveillance systems, of experimental high energy physics, and of parallel processing are presented. Audience: Researchers and graduate students in the areas of combinatorial optimization, mathematical programming, operations research, physics, and computer science.

Read Online Complexity And Approximation Combinatorial Optimization Problems And Their Approximability Properties

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.

This graduate-level text considers the Soviet ellipsoid algorithm for linear programming; efficient algorithms for network flow, matching, spanning trees, and matroids; the theory of NP-complete problems; local search heuristics for NP-complete problems, more. 1982 edition.

There has been much recent progress in approximation algorithms for nonconvex continuous and discrete problems from both a theoretical and a practical perspective. In discrete (or combinatorial) optimization many approaches have been developed recently that link the discrete universe to the continuous universe through geometric, analytic, and algebraic techniques. Such techniques include global optimization formulations, semidefinite programming, and spectral theory. As a result new approximate algorithms have been discovered and many new computational approaches have been developed. Similarly, for many continuous nonconvex optimization problems, new approximate algorithms have been developed based on semidefinite programming and new randomization techniques. On the other hand, computational complexity, originating from the interactions between computer science and numerical optimization, is one of the major theories that have revolutionized the approach to solving optimization problems and to analyzing their intrinsic difficulty. The main focus of complexity is the study of whether existing algorithms are efficient for the solution of problems, and which problems are likely to be tractable. The quest for developing efficient algorithms leads also to elegant general approaches for solving optimization problems, and reveals surprising connections among problems and their solutions. A conference on Approximation and Complexity in Numerical Optimization: Continuous and Discrete Problems was held during February 28 to March 2, 1999 at the Center for Applied Optimization of the University of Florida.

Combinatorial optimization is a multidisciplinary scientific area, lying in the interface of three major scientific domains: mathematics, theoretical computer science and management. The three volumes of the Combinatorial Optimization series aim to cover a wide range of topics in this area. These topics also deal with fundamental notions and approaches as with several classical applications of combinatorial optimization. Concepts of Combinatorial Optimization, is divided into three parts: - On the complexity of combinatorial optimization problems, presenting basics about worst-case and randomized complexity; - Classical solution methods, presenting the two most-known methods for solving hard combinatorial optimization problems, that are Branch-and-Bound and Dynamic Programming; - Elements from mathematical programming, presenting fundamentals from mathematical programming based methods that are in the heart of Operations Research since the origins of this field.

Read Online Complexity And Approximation Combinatorial Optimization Problems And Their Approximability Properties

This book constitutes the joint refereed proceedings of the 7th International Workshop on Approximation Algorithms for Combinatorial Optimization Problems, APPROX 2004 and the 8th International Workshop on Randomization and Computation, RANDOM 2004, held in Cambridge, MA, USA in August 2004. The 37 revised full papers presented were carefully reviewed and selected from 87 submissions. Among the issues addressed are design and analysis of approximation algorithms, inapproximability results, approximation classes, online problems, graph algorithms, cuts, geometric computations, network design and routing, packing and covering, scheduling, game theory, design and analysis of randomised algorithms, randomized complexity theory, pseudorandomness, derandomization, probabilistic proof systems, error-correcting codes, and other applications of approximation and randomness. Perceptive text examines shortest paths, network flows, bipartite and nonbipartite matching, matroids and the greedy algorithm, matroid intersections, and the matroid parity problems. Suitable for courses in combinatorial computing and concrete computational complexity.

This book constitutes the proceedings of the 16th International Workshop on Approximation Algorithms for Combinatorial Optimization Problems, APPROX 2013, and the 17th International Workshop on Randomization and Computation, RANDOM 2013, held in August 2013 in the USA. The total of 48 carefully reviewed and selected papers presented in this volume consist of 23 APPROX papers selected out of 46 submissions, and 25 RANDOM papers selected out of 52 submissions. APPROX 2013 focuses on algorithmic and complexity theoretic issues relevant to the development of efficient approximate solutions to computationally difficult problems, while RANDOM 2013 focuses on applications of randomness to computational and combinatorial problems.

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.

This title provides a comprehensive survey over the subject of probabilistic combinatorial optimization, discussing probabilistic versions of some of the most paradigmatic combinatorial problems on graphs, such as the maximum independent set, the minimum vertex covering, the longest path and the minimum coloring. Those who possess a sound knowledge of the subject matter will find the title of great interest, but those who have only some mathematical familiarity and knowledge about complexity and approximation theory will also find it an accessible and informative read.

Combinatorial optimization is a multidisciplinary scientific area, lying in the interface of three major scientific domains: mathematics, theoretical computer science and management. The three volumes of the Combinatorial Optimization series aim to cover a wide range of topics in this area. These topics also deal with fundamental notions and approaches as with several classical applications of combinatorial optimization. Concepts of Combinatorial Optimization, is divided into three parts: - On the complexity of combinatorial optimization problems, presenting basics about worst-case and randomized complexity; - Classical solution methods, presenting the two most-known methods for solving hard combinatorial optimization problems, that are Branch-and-Bound and Dynamic Programming; - Elements from mathematical programming, presenting fundamentals from mathematical programming based methods that are in the heart of Operations Research since the origins of this field.

RANDOM is concerned with applications of randomness to computational and combinatorial problems, and was the 13th workshop in the series following Bologna (1997), Barcelona (1998), Berkeley (1999), Geneva (2000), Berkeley (2001), Harvard (2002), Princeton (2003), Cambridge (2004), Berkeley (2005), Barcelona (2006), Princeton (2007), and Boston (2008). This book constitutes the joint refereed proceedings of the 13th International Workshop on Approximation Algorithms for Combinatorial Optimization Problems, APPROX 2010, and the

Read Online Complexity And Approximation Combinatorial Optimization Problems And Their Approximability Properties

14th International Workshop on Randomization and Computation, RANDOM 2010, held in Barcelona, Spain, in September 2010. The 28 revised full papers of the APPROX 2010 workshop and the 29 revised full papers of the RANDOM 2010 workshop included in this volume, were carefully reviewed and selected from 66 and 61 submissions, respectively. APPROX focuses on algorithmic and complexity issues surrounding the development of efficient approximate solutions to computationally difficult problems. RANDOM is concerned with applications of randomness to computational and combinatorial problems.

Clearly written graduate-level text considers the Soviet ellipsoid algorithm for linear programming; efficient algorithms for network flow, matching, spanning trees, and matroids; the theory of NP-complete problems; approximation algorithms, local search heuristics for NP-complete problems, more. "Mathematicians wishing a self-contained introduction need look no further." — American Mathematical Monthly. 1982 edition.

Complexity and Approximation Combinatorial Optimization Problems and Their Approximability Properties Springer Science & Business Media

This is a supplementary volume to the major three-volume Handbook of Combinatorial Optimization set. It can also be regarded as a stand-alone volume presenting chapters dealing with various aspects of the subject in a self-contained way.

Covering the basic techniques used in the latest research work, the author consolidates progress made so far, including some very recent and promising results, and conveys the beauty and excitement of work in the field. He gives clear, lucid explanations of key results and ideas, with intuitive proofs, and provides critical examples and numerous illustrations to help elucidate the algorithms. Many of the results presented have been simplified and new insights provided. Of interest to theoretical computer scientists, operations researchers, and discrete mathematicians.

This book constitutes the refereed proceedings of the Third International Workshop on Approximation Algorithms for Combinatorial Optimization Problems, APPROX 2000, held in Saarbrcken, Germany in September 2000. The 22 revised full papers presented together with four invited contributions were carefully reviewed and selected from 68 submissions. The topics dealt with include design and analysis of approximation algorithms, inapproximability results, on-line problems, randomization techniques, average-case analysis, approximation classes, scheduling problems, routing and flow problems, coloring and partitioning, cuts and connectivity, packing and covering, geometric problems, network design, and various applications.

[Copyright: ec90562dc17f03dfd3121b25282f4ae7](https://doi.org/10.1007/978-3-540-45121-1)