

Combinatorial Optimization

Ding-Zhu Du, Panos M. Pardalos



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Combinatorial Optimization Gerard Cornuejols, 2001-01-01 New and elegant proofs of classical results and makes difficult results accessible

Combinatorial Optimization Bernhard Korte, Jens Vygen, 2013-06-29 Combinatorial optimization is one of the youngest and most active areas of discrete mathematics and is probably its driving force today It became a subject in its own right about 50 years ago This book describes the most important ideas theoretical results and algorithms in combinatorial optimization We have conceived it as an advanced graduate text which can also be used as an up to date reference work for current research The book includes the essential fundamentals of graph theory linear and integer programming and complexity theory It covers classical topics in combinatorial optimization as well as very recent ones The emphasis is on theoretical results and algorithms with provably good performance Applications and heuristics are mentioned only occasionally Combinatorial optimization has its roots in combinatorics operations research and theoretical computer science A main motivation is that thousands of real life problems can be formulated as abstract combinatorial optimization problems We focus on the detailed study of classical problems which occur in many different contexts together with the underlying theory Most combinatorial optimization problems can be formulated naturally in terms of graphs and as integer linear programs Therefore this book starts after an introduction by reviewing basic graph theory and proving those results in linear and integer programming which are most relevant for combinatorial optimization

Combinatorial Optimization Christos H. Papadimitriou, Kenneth Steiglitz, 1998-01-01 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

Concepts of Combinatorial Optimization Vangelis Th. Paschos, 2014-08-08 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

Combinatorial Optimization William J. Cook, William H. Cunningham, William R. Pulleyblank, Alexander Schrijver, 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

Combinatorial Optimization Bernhard H. Korte, Jens Vygen, 2002 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

Differential Evolution: A Handbook for Global Permutation-Based Combinatorial Optimization Godfrey C. Onwubolu, Donald Davendra, 2009-01-13 This is the first book devoted entirely to Differential Evolution DE for global permutative based combinatorial optimization Since its original development DE has mainly been applied to solving problems characterized by continuous parameters This means that only a subset of real world problems could be solved by the original classical DE algorithm This book presents in detail the various permutative based combinatorial DE formulations by their initiators in an easy to follow manner through extensive illustrations and computer code It is a valuable resource for professionals and students interested in DE in order to have full potentials of DE at their disposal as a proven optimizer All source programs in C and Mathematica programming languages are downloadable from the website of Springer

Polyhedral Techniques in Combinatorial Optimization Karen Aardal, Stan van Hoesel, 1995

Integer Programming and Related Areas R.v. Randow, 2012-12-06

Complexity and Approximation Giorgio Ausiello, Pierluigi Crescenzi, Giorgio Gambosi, Viggo Kann, Alberto Marchetti-Spaccamela, Marco Protasi, 2012-12-06

N COMPUTER applications we are used to live with approximation Various notions of approximation appear in fact in many circumstances One notable example is the type of approximation that arises in numerical analysis or in computational geometry from the fact that we cannot perform computations with arbitrary precision and we have to truncate the representation of real numbers In other cases we use to approximate complex mathematical objects by simpler ones for example we sometimes represent non linear functions by means of piecewise linear ones The need to solve difficult optimization problems is another reason that forces us to deal with approximation In particular when a problem is computationally hard i.e. the only way we know to solve it is by making use of an algorithm that runs in exponential time it may be practically unfeasible to try to compute the exact solution

because it might require months or years of machine time even with the help of powerful parallel computers In such cases we may decide to restrict ourselves to compute a solution that though not being an optimal one nevertheless is close to the optimum and may be determined in polynomial time We call this type of solution an approximate solution and the corresponding algorithm a polynomial time approximation algorithm Most combinatorial optimization problems of great practical relevance are indeed computationally intractable in the above sense In formal terms they are classified as N_p hard optimization problems

Theoretical Aspects of Local Search Wil Michiels, Emile Aarts, Jan Korst, 2007-01-17 Local search has been applied successfully to a diverse collection of optimization problems It is appreciated for its basic conceptual foundation its general applicability and its power to serve as a source for new search paradigms The typical characteristics of combinatorial optimization problems to which local search can be applied its relation to complexity theory and the combination with randomized search features have led to a wealth of interesting theoretical results However these results are scattered throughout the literature This is the first book that presents a large collection of theoretical results in a consistent manner thus providing the reader with a coherent overview of the achievements obtained so far but also serving as a source of inspiration for the development of novel results in the challenging field of local search

Combinatorial Optimization Eugene L. Lawler, 2001-01-01 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

Introduction to Genetic Algorithms S.N. Sivanandam, S. N. Deepa, 2007-10-24 The origin of evolutionary algorithms was an attempt to mimic some of the processes taking place in natural evolution Although the details of biological evolution are not completely understood even nowadays there exist some points supported by strong experimental evidence Evolution is a process operating over chromosomes rather than over organisms The former are organic tools encoding the structure of a living being i.e. a creature is built decoding a set of chromosomes Natural selection is the mechanism that relates chromosomes with the efficiency of the entity they represent thus allowing that efficient organism which is well adapted to the environment to reproduce more often than those which are not The evolutionary process takes place during the reproduction stage There exists a large number of reproductive mechanisms in Nature Most common ones are mutation that causes the chromosomes of offspring to be different to those of the parents and recombination that combines the chromosomes of the parents to produce the offspring Based upon the features above the three mentioned models of evolutionary computing were independently and almost simultaneously developed

Automatic Generation Of Algorithms Victor Parada, 2025-02-10 In the rapidly evolving domain of computational problem solving this book delves into the cutting edge Automatic Generation of Algorithms AGA paradigm a groundbreaking approach poised to redefine algorithm design for optimization problems Spanning combinatorial optimization machine learning genetic programming and beyond it investigates AGA's transformative capabilities across

diverse application areas The book initiates by introducing fundamental combinatorial optimization concepts and NP-hardness significance laying the foundation for understanding AGA's necessity and potential It then scrutinizes the pivotal Master Problem concept in AGA and the art of modeling for algorithm generation The exploration progresses with integrating genetic programming and synergizing AGA with evolutionary computing Subsequent chapters delve into the AGA machine learning intersection highlighting their shared optimization foundation while contrasting divergent objectives The automatic generation of metaheuristics is examined aiming to develop versatile algorithmic frameworks adaptable to various optimization problems Furthermore the book explores applying reinforcement learning techniques to automatic algorithm generation Throughout it invites readers to reimagine algorithmic design boundaries offering insights into AGA's conceptual underpinnings practical applications and future directions serving as an invitation for researchers practitioners and enthusiasts in computer science operations research artificial intelligence and beyond to embark on a journey toward computational excellence where algorithms are born evolved and adapted to meet ever-changing real-world problem landscapes

Combinatorial Optimization Mustafa Akgül, Horst W. Hamacher, Süleyman Tüfekci, 2012-12-06 There have been significant developments in the theory and practice of combinatorial optimization in the last 15 years This progress has been evidenced by a continuously increasing number of international and local conferences books and papers in this area This book is also another contribution to this burgeoning area of operations research and optimization This volume contains the contributions of the participants of the recent NATO Advanced Study Institute New Frontiers in the Theory and Practice of Combinatorial Optimization which was held at the campus of Bilkent University in Ankara Turkey July 16-29 1990 In this conference we brought many prominent researchers and young and promising scientists together to discuss current and future trends in the theory and practice of combinatorial optimization The Bilkent campus was an excellent environment for such an undertaking Being outside of Ankara the capital of Turkey Bilkent University gave the participants a great opportunity for exchanging ideas and discussing new theories and applications without much distraction One of the primary goals of NATO ASIs is to bring together a group of scientists and research scientists primarily from the NATO countries for the dissemination of advanced scientific knowledge and the promotion of international contacts among scientists We believe that we accomplished this mission very successfully by bringing together 15 prominent lecturers and 45 promising young scientists from 12 countries in a university environment for 14 days of intense lectures presentations and discussions

Proceedings of the 2023 4th International Conference on Management Science and Engineering Management (ICMSEM 2023) Suhaiza Hanim Binti Dato Mohamad Zailani, Kosga Yagapparaj, Norhayati Zakuan, 2023-10-07 This is an open access book Management science aims to study the dynamic study of human use of limited resources in management activities to achieve organizational goals complex and innovative social behavior and its laws And engineering management refers to the management of important and complex new products equipment and devices in the process of development

manufacturing and production and also includes the study and management of technological innovation technological transformation transformation layout and strategy of industrial engineering technology development The development or breakthrough of management theory is accompanied by the development and progress of science and technology and the level of science and technology and the level of management theory in each historical period are mutually adaptive and it can be said that the progress of science and technology plays an important role in promoting the development of management At the same time the rapid development and progress of science and technology give a strong injection to the development of engineering and provide the possibility for engineering construction can use new technology new equipment new technology and new materials Modern management is an important development direction of management science nowadays And the use of modern management in engineering has an important role in saving social costs ensuring project quality and improving safety awareness and behavior ICMSEM 2023 will focus on modern management discuss about the benefits that modernization brings to engineering ICMSEM 2023 aims to Develop and advance management science through the study and application of certain issues Open up new perspectives in the sharing of speakers and inspire the audience to new ways of managing in engineering Create a forum for sharing research and exchange at the international level so that the participants can be informed of the latest research directions results and contents of management science which will inspire them to new ideas for research and practice

Artificial Neural Networks P.J. Braspenning, F. Thuijsman, A.J.M.M. Weijters, 1995-06-02 This book presents carefully revised versions of tutorial lectures given during a School on Artificial Neural Networks for the industrial world held at the University of Limburg in Maastricht Belgium The major ANN architectures are discussed to show their powerful possibilities for empirical data analysis particularly in situations where other methods seem to fail Theoretical insight is offered by examining the underlying mathematical principles in a detailed yet clear and illuminating way Practical experience is provided by discussing several real world applications in such areas as control optimization pattern recognition software engineering robotics operations research and CAM

Handbook of Combinatorial Optimization Ding-Zhu Du, Panos M. Pardalos, 2013-12-01 Combinatorial or discrete optimization is one of the most active fields in the interface of operations research computer science and applied mathematics Combinatorial optimization problems arise in various applications including communications network design VLSI design machine vision air line crew scheduling corporate planning computer aided design and manufacturing database query design cellular telephone frequency assignment constraint directed reasoning and computational biology Furthermore combinatorial optimization problems occur in many diverse areas such as linear and integer programming graph theory artificial intelligence and number theory All these problems when formulated mathematically as the minimization or maximization of a certain function defined on some domain have a commonality of discreteness Historically combinatorial optimization starts with linear programming Linear programming has an entire range of important applications including production planning and

distribution personnel assignment finance allocation of economic resources circuit simulation and control systems Leonid Kantorovich and Tjalling Koopmans received the Nobel Prize 1975 for their work on the optimal allocation of resources Two important discoveries the ellipsoid method 1979 and interior point approaches 1984 both provide polynomial time algorithms for linear programming These algorithms have had a profound effect in combinatorial optimization Many polynomial time solvable combinatorial optimization problems are special cases of linear programming e.g. matching and maximum flow In addition linear programming relaxations are often the basis for many approximation algorithms for solving NP hard problems e.g. dualheuristics

Geometric Algorithms and Combinatorial Optimization Martin

Grötschel, Laszlo Lovasz, Alexander Schrijver, 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

Combinatorial Optimization Problems in Planning and Decision Making Michael Z. Zgurovsky, Alexander A. Pavlov, 2018-09-24 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

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