

Stasys Jukna

Extremal Combinatorics

With Applications in Computer Science
Second Edition



Springer

Extremal Combinatorics With Applications In Computer Science

Klaus Weihrauch



Extremal Combinatorics With Applications In Computer Science:

Extremal Combinatorics Stasys Jukna, 2011-08-31 This book is a concise self contained up to date introduction to extremal combinatorics for nonspecialists There is a strong emphasis on theorems with particularly elegant and informative proofs they may be called gems of the theory The author presents a wide spectrum of the most powerful combinatorial tools together with impressive applications in computer science methods of extremal set theory the linear algebra method the probabilistic method and fragments of Ramsey theory No special knowledge in combinatorics or computer science is assumed the text is self contained and the proofs can be enjoyed by undergraduate students in mathematics and computer science Over 300 exercises of varying difficulty and hints to their solution complete the text This second edition has been extended with substantial new material and has been revised and updated throughout It offers three new chapters on expander graphs and eigenvalues the polynomial method and error correcting codes Most of the remaining chapters also include new material such as the Kruskal Katona theorem on shadows the Lov sz Stein theorem on coverings large cliques in dense graphs without induced 4 cycles a new lower bounds argument for monotone formulas Dvir s solution of the finite field Kakeya conjecture Moser s algorithmic version of the Lov sz Local Lemma Sch nung s algorithm for 3 SAT the Szemer di Trotter theorem on the number of point line incidences surprising applications of expander graphs in extremal number theory and some other new results

Extremal Combinatorics Stasys Jukna, 2001-06-12 This is a concise up to date introduction to extremal combinatorics for non specialists Strong emphasis is made on theorems with particularly elegant and informative proofs which may be called the gems of the theory A wide spectrum of the most powerful combinatorial tools is presented including methods of extremal set theory the linear algebra method the probabilistic method and fragments of Ramsey theory A thorough discussion of recent applications to computer science illustrates the inherent usefulness of these methods

Extremal Combinatorics with Applications in Computer Science: with 36 Figures and 315 Exercises Stasys Jukna, 2001

Computing and Combinatorics Dachuan Xu, Donglei Du, Dingzhu Du, 2015-06-23 This book constitutes the refereed proceedings of the 21st International Conference on Computing and Combinatorics COCOON 2015 held in Beijing China in August 2015 The 49 revised full papers and 11 shorter papers presented were carefully reviewed and selected from various submissions The papers cover various topics including algorithms and data structures algorithmic game theory approximation algorithms and online algorithms automata languages logic and computability complexity theory computational learning theory cryptography reliability and security database theory computational biology and bioinformatics computational algebra geometry number theory graph drawing and information visualization graph theory communication networks optimization and parallel and distributed computing

Automata, Languages and Programming Luca Aceto, Ivan Damgaard, Leslie Ann Goldberg, Magnus M. Halldorsson, Anna Ingolfsdottir, Igor Walukiewicz, 2008-06-24 Annotation The two volume set LNCS 5125 and LNCS 5126 constitutes the refereed proceedings of

the 35th International Colloquium on Automata Languages and Programming ICALP 2008 held in Reykjavik Iceland in July 2008 The 126 revised full papers presented together with 4 invited lectures were carefully reviewed and selected from a total of 407 submissions The papers are grouped in three major tracks on algorithms automata complexity and games on logic semantics and theory of programming and on security and cryptography foundations LNCS 5126 contains 56 contributions of track B and track C selected from 208 submissions and 2 invited lectures The papers for track B are organized in topical sections on bounds distributed computation real time and probabilistic systems logic and complexity words and trees nonstandard models of computation reasoning about computation and verification The papers of track C cover topics in security and cryptography such as theory secure computation two party protocols and zero knowledge encryption with special properties quantum cryptography various types of hashing as well as public key cryptography and authentication

Computable Analysis Klaus Weihrauch, 2012-12-06 Is the exponential function computable Are union and intersection of closed subsets of the real plane computable Are differentiation and integration computable operators Is zero finding for complex polynomials computable Is the Mandelbrot set decidable And in case of computability what is the computational complexity Computable analysis supplies exact definitions for these and many other similar questions and tries to solve them Merging fundamental concepts of analysis and recursion theory to a new exciting theory this book provides a solid basis for studying various aspects of computability and complexity in analysis It is the result of an introductory course given for several years and is written in a style suitable for graduate level and senior students in computer science and mathematics Many examples illustrate the new concepts while numerous exercises of varying difficulty extend the material and stimulate readers to work actively on the text *Parameterized Complexity Theory* J. Flum, M. Grohe, 2006-05-01 Parameterized complexity theory is a recent branch of computational complexity theory that provides a framework for a refined analysis of hard algorithmic problems The central notion of the theory fixed parameter tractability has led to the development of various new algorithmic techniques and a whole new theory of intractability This book is a state of the art introduction to both algorithmic techniques for fixed parameter tractability and the structural theory of parameterized complexity classes and it presents detailed proofs of recent advanced results that have not appeared in book form before Several chapters are each devoted to intractability algorithmic techniques for designing fixed parameter tractable algorithms and bounded fixed parameter tractability and subexponential time complexity The treatment is comprehensive and the reader is supported with exercises notes a detailed index and some background on complexity theory and logic The book will be of interest to computer scientists mathematicians and graduate students engaged with algorithms and problem complexity

Kernelization Fedor V. Fomin, Daniel Lokshtanov, Saket Saurabh, Meirav Zehavi, 2019-01-10 Preprocessing or data reduction is a standard technique for simplifying and speeding up computation Written by a team of experts in the field this book introduces a rapidly developing area of preprocessing analysis known as kernelization The authors provide an overview

of basic methods and important results with accessible explanations of the most recent advances in the area such as meta kernelization representative sets polynomial lower bounds and lossy kernelization The text is divided into four parts which cover the different theoretical aspects of the area upper bounds meta theorems lower bounds and beyond kernelization The methods are demonstrated through extensive examples using a single data set Written to be self contained the book only requires a basic background in algorithmics and will be of use to professionals researchers and graduate students in theoretical computer science optimization combinatorics and related fields **ECAI 2016** G.A. Kaminka,M. Fox,P. Bouquet,2016-08-24 Artificial Intelligence continues to be one of the most exciting and fast developing fields of computer science This book presents the 177 long papers and 123 short papers accepted for ECAI 2016 the latest edition of the biennial European Conference on Artificial Intelligence Europe s premier venue for presenting scientific results in AI The conference was held in The Hague the Netherlands from August 29 to September 2 2016 ECAI 2016 also incorporated the conference on Prestigious Applications of Intelligent Systems PAIS 2016 and the Starting AI Researcher Symposium STAIRS The papers from PAIS are included in this volume the papers from STAIRS are published in a separate volume in the Frontiers in Artificial Intelligence and Applications FAIA series Organized by the European Association for Artificial Intelligence EurAI and the Benelux Association for Artificial Intelligence BNVKI the ECAI conference provides an opportunity for researchers to present and hear about the very best research in contemporary AI This proceedings will be of interest to all those seeking an overview of the very latest innovations and developments in this field The Complexity Theory Companion Lane A. Hemaspaandra,Mitsunori Ogihara,2013-03-14 The Complexity Theory Companion is an accessible algorithmically oriented research centered up to date guide to some of the most interesting techniques of complexity theory The book s thesis is that simple algorithms are at the heart of complexity theory From the tree pruning and interval pruning algorithms that shape the first chapter to the query simulation procedures that dominate the last chapter the central proof methods of the book are algorithmic And to more clearly highlight the role of algorithmic techniques in complexity theory the book is unlike other texts on complexity organized by technique rather than by topic Each chapter of this book focuses on one technique what it is and what results and applications it yields This textbook was developed at the University of Rochester in courses given to graduate students and advanced undergraduates Researchers also will find this book a valuable source of reference due to the comprehensive bibliography of close to five hundred entries the thirty five page subject index and the appendices giving overviews of complexity classes and reductions *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 s 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

Theory of Semi-Feasible Algorithms Lane A. Hemaspaandra, Leen Torenvliet, 2013-04-17 An Invitation to the Dance It is an underappreciated fact that sets may have various types of complexity and not all types are in harmony with each other The primary goal of this book is to unify and make more widely accessible a vibrant stream of research the theory of semi feasible computation that perfectly showcases the richness of and contrasts between the central types of complexity The semi feasible sets which are most commonly referred to as the P selective sets are those sets L for which there is a deterministic polynomial time algorithm that when given as input any two strings of which at least one belongs to L will output one of them that is in L The reason we say that the semi feasible sets showcase the contrasts among types of complexity is that it is well known that many semi feasible sets have no recursive algorithms thus their time complexity cannot be upper bounded by standard time complexity classes yet all semi feasible sets are simple in a wide range of other natural senses In particular the semi feasible sets have small circuits they are in the extended low hierarchy and they cannot be NP complete unless $P = NP$ The semi feasible sets are fascinating for many reasons First as mentioned above they showcase the fact that mere deterministic time complexity is not the only potential type of complexity in the world of computation Mathematical Foundations of Computer Science 2005 Joanna Jedrzejowicz, 2005-08-17 This book constitutes the refereed proceedings of the 30th International Symposium on Mathematical Foundations of Computer Science MFCS 2005 held in Gdansk Poland in August-September 2005 The 62 revised full papers presented together with full papers or abstracts of 7 invited talks were carefully reviewed and selected from 137 submissions All current aspects in theoretical computer science are addressed ranging from quantum computing approximation automata circuits scheduling games languages discrete mathematics combinatorial optimization graph theory networking algorithms and complexity to programming theory formal methods and mathematical logic **Algorithms and Computation** Khaled Elbassioni, Kazuhisa Makino, 2015-12-07 This book constitutes the refereed proceedings of the 26th International Symposium on Algorithms and Computation ISAAC 2015 held in Nagoya Japan in December 2015 The 65 revised full papers presented together with 3 invited talks were carefully reviewed and selected from 180 submissions for inclusion in the book The focus of the volume is on the following topics computational geometry data structures combinatorial optimization and approximation algorithms randomized algorithms graph algorithms and FPT computational complexity graph drawing and planar graphs online and streaming algorithms and string and DNA algorithms *Next Generation Society Technological and Legal Issues* Alexander B. Sideridis, Charalampos Z. Patrikakis, 2010-01-30 Recent developments in information and communication technology ICT have paved the way for a world of advanced communication intelligent information processing and ubiquitous access to information and services The

ability to work communicate interact conduct business and enjoy digital entertainment virtually anywhere is rapidly becoming commonplace due to a multitude of small devices ranging from mobile phones and PDAs to RFID tags and wearable computers The increasing number of connected devices and the proliferation of networks provide no indication of a slowdown in this tendency On the negative side misuse of this same technology entails serious risks in various aspects such as privacy violations advanced electronic crime cyber terrorism and even enlargement of the digital divide In extreme cases it may even threaten basic principles and human rights The aforementioned issues raise an important question Is our society ready to adopt the technological advances in ubiquitous networking next generation Internet and pervasive computing To what extent will it manage to evolve promptly and efficiently to a next generation society adopting the forthcoming ICT challenges The Third International ICST Conference on e Democracy held in Athens Greece during September 23-25 2009 focused on the above issues Through a comprehensive list of thematic areas under the title Next Generation Society Technological and Legal issues the 2009 conference provided comprehensive reports and stimulated discussions on the technological ethical legal and political challenges ahead of us

Knowledge Discovery in Inductive Databases Francesco Bonchi, Jean-Francois Boulicaut, 2006-03-05 This book presents the thoroughly refereed joint postproceedings of the 4th International Workshop on Knowledge Discovery in Inductive Databases October 2005 20 revised full papers presented together with 2 are reproduced here Bringing together the fields of databases machine learning and data mining the papers address various current topics in knowledge discovery and data mining in the framework of inductive databases such as constraint based mining database technology and inductive querying

Mastering Discrete Mathematics Gautami Devar, 2025-02-20 Mastering Discrete Mathematics is a comprehensive and accessible resource designed to provide readers with a thorough understanding of the fundamental concepts techniques and applications of discrete mathematics Written for students educators researchers and practitioners we offer a detailed overview of discrete mathematics a field that deals with countable distinct objects and structures We cover a wide range of topics including sets logic proof techniques combinatorics graph theory recurrence relations and generating functions Our clear and concise language makes complex mathematical concepts accessible to readers with varying levels of mathematical background Each concept is illustrated with examples and applications to demonstrate its relevance and practical significance in various domains Emphasizing the practical applications of discrete mathematics we explore its use in computer science cryptography optimization network theory and other scientific disciplines Each chapter includes exercises and problems to reinforce learning test understanding and encourage further exploration of the material Additional resources including supplementary materials interactive exercises and solutions to selected problems are available online to complement the book and facilitate self study and review Whether you are a student looking to gain a solid foundation in discrete mathematics an educator seeking to enhance your teaching materials or a practitioner interested in applying discrete mathematics techniques to real world problems Mastering Discrete Mathematics

offers valuable insights and resources to support your learning and exploration of this fascinating field Mathematical Foundations of Computer Science 2006 Rastislav Královic, Pawel Urzyczyn, 2006-08-11 This book constitutes the refereed proceedings of the 31st International Symposium on Mathematical Foundations of Computer Science MFCS 2006 The book presents 62 revised full papers together with the full papers or abstracts of 7 invited talks All current aspects in theoretical computer science and its mathematical foundations are addressed from algorithms and data structures to complexity automata semantics logic formal specifications models of computation concurrency theory computational geometry and more

Approximation, Randomization, and Combinatorial Optimization. Algorithms and Techniques Irit Dinur, Klaus Jansen, Seffi Naor, José Rolim, 2009-08-21 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 **Handbook of Mathematical Induction** David S. Gunderson, 2014-01-09 Handbook of Mathematical Induction Theory and Applications shows how to find and write proofs via mathematical induction This comprehensive book covers the theory the structure of the written proof all standard exercises and hundreds of application examples from nearly every area of mathematics In the first part of the book the author discuss

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