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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.
Applied combinatorics - 1980

Graph Theory, 1736-1936 - Norman Biggs 1986
First published in 1976, this book has been widely acclaimed both for its significant contribution to the history of mathematics and for the way that it brings the subject alive. Building on a set of original writings from some of the founders of graph theory, the book traces the historical development of the subject through a linking commentary. The relevant underlying mathematics is also explained, providing an original introduction to the subject for students. From reviews: 'The book...serves as an excellent examplein fact, as a modelof a new approach to one aspect of mathematics, when mathematics is considered as a living, vital and developing tradition.' (Edward A. Maziark in Isis) 'Biggs, Lloyd and Wilson's unusual and remarkable book traces the evolution and development of graph theory...Conceived in a very original manner and obviously written with devotion and a very great amount of painstaking historical research, it contains an exceptionally fine collection of source material, and to a graph theorist it is a treasure chest of fascinating

historical information and curiosities with rich food for thought.'(Gabriel Dirac in Centaurus) 'The lucidity, grace and wit of the writing makes this book a pleasure to read and re-read.' (S. H. Hollingdale in Bulletin of the Institute of Mathematics and its Applications)

A Walk Through Combinatorics - Miklós Bóna 2011-05-09
This is a textbook for an introductory combinatorics course lasting one or two semesters. An extensive list of problems, ranging from routine exercises to research questions, is included. In each section, there are also exercises that contain material not explicitly discussed in the preceding text, so as to provide instructors with extra choices if they want to shift the emphasis of their course. Just as with the first two editions, the new edition walks the reader through the classic parts of combinatorial enumeration and graph theory, while also discussing some recent progress in the area: on the one hand, providing material that will help students learn the basic techniques, and on the other hand, showing that some questions at the forefront of research are comprehensible and accessible to the talented and hardworking undergraduate. The basic topics discussed are: the twelvefold way, cycles in permutations, the formula of inclusion and exclusion, the notion of graphs and trees, matchings, Eulerian and Hamiltonian cycles, and planar graphs. The selected advanced topics are: Ramsey theory, pattern avoidance, the probabilistic method, partially ordered sets, the theory of designs (new to this edition), enumeration under group action (new to this edition), generating functions of labeled and unlabeled structures and algorithms and complexity. As the goal of the book is to encourage students to learn more combinatorics, every effort has been made to provide them with a not only useful, but also enjoyable and engaging reading. The Solution Manual is available upon request for all instructors who adopt this book as a course text. Please send your request to sales@wspc.com. Sample Chapter(s) Chapter 1: Seven Is More Than Six. The Pigeon-Hole Principle (181 KB) Chapter 4: No Matter How You Slice It. The Binomial Theorem and Related Identities (228 KB) Chapter 15: Who Knows What It Looks Like,But It Exists. The Probabilistic Method (286 KB) Request Inspection Copy

Recent Advances in Algorithms and Combinatorics - Bruce A. Reed 2003
Excellent authors, such as Lovasz, one of the five best combinatorialists in the world; Thematic linking that makes it a coherent collection; Will appeal to a variety of communities, such as mathematics, computer science and operations research

Understanding Machine Learning - Shai Shalev-Shwartz 2014-05-19
Introduces machine learning and its algorithmic paradigms, explaining the principles behind automated learning approaches and the considerations underlying their usage.

Algebraic Combinatorics - Richard P. Stanley 2013-06-17
Written by one of the foremost experts in the field, Algebraic Combinatorics is a unique undergraduate textbook that will prepare the next generation of pure and applied mathematicians. The combination of the author's extensive knowledge of combinatorics and classical and practical tools from algebra will inspire motivated students to delve deeply into the fascinating interplay between algebra and combinatorics. Readers will be able to apply their newfound knowledge to mathematical, engineering, and business models. The text is primarily intended for use in a one-semester advanced undergraduate course in algebraic combinatorics, enumerative combinatorics, or graph theory. Prerequisites include a basic knowledge of linear algebra over a field, existence of finite fields, and group theory. The topics in each chapter build on one another and include extensive problem sets as well as hints to selected exercises. Key topics include walks on graphs, cubes and the Radon transform, the Matrix–Tree Theorem, and the Sperner property. There are also three appendices on purely enumerative aspects of combinatorics related to the chapter material: the RSK algorithm, plane partitions, and the enumeration of labeled trees. Richard Stanley is currently professor of Applied Mathematics at the Massachusetts Institute of Technology. Stanley has received several awards including the George Polya Prize in applied combinatorics, the Guggenheim Fellowship, and the Leroy P. Steele Prize for mathematical exposition. Also by the author: Combinatorics and Commutative Algebra, Second

Edition, © Birkhauser.

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.

A Walk Through Combinatorics - Mikl¢s B¢na 2006
This is a textbook for an introductory combinatorics course that can take up one or two semesters. An extensive list of problems, ranging from routine exercises to research questions, is included. In each section, there are also exercises that contain material not explicitly discussed in the preceding text, so as to provide instructors with extra choices if they want to shift the emphasis of their course. Just as with the first edition, the new edition walks the reader through the classic parts of combinatorial enumeration and graph theory, while also discussing some recent progress in the area: on the one hand, providing material that will help students learn the basic techniques, and on the other hand, showing that some questions at the forefront of research are comprehensible and accessible for the talented and hard-working undergraduate. The basic topics discussed are: the twelvefold way, cycles in permutations, the formula of inclusion and exclusion, the notion of graphs and trees, matchings and Eulerian and Hamiltonian cycles. The selected advanced topics are: Ramsey theory, pattern avoidance, the probabilistic method, partially ordered sets, and algorithms and complexity. As the goal of the book is to encourage students to learn more combinatorics, every effort has been made to provide them with a not only useful, but also enjoyable and engaging reading.

Graph Theory, Combinatorics and Algorithms - Martin Charles Golumbic 2006-03-30
Graph Theory, Combinatorics and Algorithms: Interdisciplinary Applications focuses on discrete mathematics and combinatorial algorithms interacting with real world problems in computer science, operations research, applied mathematics and engineering. The book contains eleven chapters written by experts in their respective fields, and covers a wide spectrum of high-interest problems across these discipline domains. Among the contributing authors are Richard Karp of UC Berkeley and Robert Tarjan of Princeton; both are at the pinnacle of research scholarship in Graph Theory and Combinatorics. The chapters from the contributing authors focus on "real world" applications, all of which will be of considerable interest across the areas of Operations Research, Computer Science, Applied Mathematics, and Engineering. These problems include Internet congestion control, high-speed communication networks, multi-object auctions, resource allocation, software testing, data structures, etc. In sum, this is a book focused on major, contemporary problems, written by the top research scholars in the field, using cutting-edge mathematical and computational techniques.

Combinatorics - Peter J. Cameron 1994-10-06
Combinatorics is a subject of increasing importance, owing to its links with computer science, statistics and algebra. This is a textbook aimed at second-year undergraduates to beginning graduates. It stresses common techniques (such as generating functions and recursive construction) which underlie the great variety of subject matter and also stresses the fact that a constructive or algorithmic proof is more valuable than an existence proof. The book is divided into two parts, the second at a higher level and with a wider range than the first. Historical notes are included which give a wider perspective on the subject. More advanced topics are given as projects and there are a number of exercises, some with solutions given.

Parameterized Algorithms - Marek Cygan 2015-07-20
This comprehensive textbook presents a clean and coherent account of most fundamental tools and techniques in Parameterized Algorithms and is a self-contained guide to the area. The book covers many of the recent developments of the field, including application of important separators, branching based on linear programming, Cut & Count to obtain faster algorithms on tree decompositions, algorithms based on representative families of matroids, and use of the Strong Exponential Time Hypothesis.

A number of older results are revisited and explained in a modern and didactic way. The book provides a toolbox of algorithmic techniques. Part I is an overview of basic techniques, each chapter discussing a certain algorithmic paradigm. The material covered in this part can be used for an introductory course on fixed-parameter tractability. Part II discusses more advanced and specialized algorithmic ideas, bringing the reader to the cutting edge of current research. Part III presents complexity results and lower bounds, giving negative evidence by way of W[1]-hardness, the Exponential Time Hypothesis, and kernelization lower bounds. All the results and concepts are introduced at a level accessible to graduate students and advanced undergraduate students. Every chapter is accompanied by exercises, many with hints, while the bibliographic notes point to original publications and related work.

Discrete Mathematics with Proof - Eric Gossett 2009-06-22
A Trusted Guide to Discrete Mathematics with Proof?Now in a Newly Revised Edition Discrete mathematics has become increasingly popular in recent years due to its growing applications in the field of computer science. Discrete Mathematics with Proof, Second Edition continues to facilitate an up-to-date understanding of this important topic, exposing readers to a wide range of modern and technological applications. The book begins with an introductory chapter that provides an accessible explanation of discrete mathematics. Subsequent chapters explore additional related topics including counting, finite probability theory, recursion, formal models in computer science, graph theory, trees, the concepts of functions, and relations. Additional features of the Second Edition include: An intense focus on the formal settings of proofs and their techniques, such as constructive proofs, proof by contradiction, and combinatorial proofs New sections on applications of elementary number theory, multidimensional induction, counting tulips, and the binomial distribution Important examples from the field of computer science presented as applications including the Halting problem, Shannon's mathematical model of information, regular expressions, XML, and Normal Forms in relational databases Numerous examples that are not often found in books on discrete mathematics including the deferred

acceptance algorithm, the Boyer-Moore algorithm for pattern matching, Sierpinski curves, adaptive quadrature, the Josephus problem, and the five-color theorem Extensive appendices that outline supplemental material on analyzing claims and writing mathematics, along with solutions to selected chapter exercises Combinatorics receives a full chapter treatment that extends beyond the combinations and permutations material by delving into non-standard topics such as Latin squares, finite projective planes, balanced incomplete block designs, coding theory, partitions, occupancy problems, Stirling numbers, Ramsey numbers, and systems of distinct representatives. A related Web site features animations and visualizations of combinatorial proofs that assist readers with comprehension. In addition, approximately 500 examples and over 2,800 exercises are presented throughout the book to motivate ideas and illustrate the proofs and conclusions of theorems. Assuming only a basic background in calculus, Discrete Mathematics with Proof, Second Edition is an excellent book for mathematics and computer science courses at the undergraduate level. It is also a valuable resource for professionals in various technical fields who would like an introduction to discrete mathematics.

Combinatorial Algorithms on Words - Alberto Apostolico 2013-06-29
Combinatorial Algorithms on Words refers to the collection of manipulations of strings of symbols (words) - not necessarily from a finite alphabet - that exploit the combinatorial properties of the logical/physical input arrangement to achieve efficient computational performances. The model of computation may be any of the established serial paradigms (e.g. RAM's, Turing Machines), or one of the emerging parallel models (e.g. PRAM ,WRAM, Systolic Arrays, CCC). This book focuses on some of the accomplishments of recent years in such disparate areas as pattern matching, data compression, free groups, coding theory, parallel and VLSI computation, and symbolic dynamics; these share a common flavor, yet ltave not been examined together in the past. In addition to being theoretically interest ing, these studies have had significant applications. It happens that these works have all too frequently been carried out in isolation, with contributions addressing similar issues scattered

throughout a rather diverse body of literature. We felt that it would be advantageous to both current and future researchers to collect this work in a sin gle reference. It should be clear that the book's emphasis is on aspects of combinatorics and com plexity rather than logic, foundations, and decidability. In view of the large body of research and the degree of unity already achieved by studies in the theory of auto mata and formal languages, we have allocated very little space to them.

Designs, Graphs, Codes and their Links - P. J. Cameron 1991-09-19
This book stresses the connection between, and the applications of, design theory to graphs and codes. Beginning with a brief introduction to design theory and the necessary background, the book also provides relevant topics for discussion from the theory of graphs and codes.

Combinatorial Optimization - Christos H. Papadimitriou 2013-04-26
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.

Introduction to Algebra - Peter J. Cameron 2007-12-14
Developed to meet the needs of modern students, this Second Edition of the classic algebra text by Peter Cameron covers all the abstract algebra an undergraduate student is likely to need. Starting with an introductory overview of numbers, sets and functions, matrices, polynomials, and modular arithmetic, the text then introduces the most important algebraic structures: groups, rings and fields, and their properties. This is followed by coverage of vector spaces and modules with applications to abelian groups and canonical forms before returning to the construction of the number systems, including the existence of transcendental numbers. The final chapters take the reader further into the theory of groups, rings and fields, coding theory, and Galois theory. With over 300 exercises, and web-based solutions, this is an ideal introductory text for Year 1 and 2 undergraduate students in mathematics.

Computational Complexity - Sanjeev Arora 2009-04-20
New and classical results in computational complexity, including interactive proofs, PCP, derandomization, and quantum computation. Ideal for graduate students.

Advanced Combinatorics - Louis Comtet 2012-12-06
Notwithstanding its title, the reader will not find in this book a systematic account of this huge subject. Certain classical aspects have been passed by, and the true title ought to be "Various questions of elementary combina torial analysis". For instance, we only touch upon the subject of graphs and configurations, but there exists a very extensive and good literature on this subject. For this we refer the reader to the bibliography at the end of the volume. The true beginnings of combinatorial analysis (also called combina tory analysis) coincide with the beginnings of probability theory in the 17th century. For about two centuries it vanished as an autonomous sub ject. But the advance of statistics, with an ever-increasing demand for configurations as well as the advent and development of computers, have, beyond doubt, contributed to reinstating this subject after such a long period of negligence. For a long time the aim of combinatorial analysis was to count the different ways of arranging objects under given circumstances. Hence, many of the traditional problems of analysis or geometry which are con cerned at a certain moment with finite structures, have a combinatorial character. Today, combinatorial analysis is also relevant to problems of existence, estimation and structuration, like all other parts of mathema tics, but exclusively forjinite sets.

Combinatorial Optimization and Graph Algorithms - Takuro Fukunaga 2017-10-02
Covering network designs, discrete convex analysis, facility location and clustering problems, matching games, and parameterized complexity, this book discusses theoretical aspects of combinatorial optimization and graph algorithms. Contributions are by renowned researchers who attended NII Shonan meetings on this essential topic. The collection contained here provides readers with the outcome of the authors' research and productive meetings on this dynamic area, ranging from computer science and mathematics to operations research. Networks are ubiquitous in today's world: the Web, online social networks, and search-

and-query click logs can lead to a graph that consists of vertices and edges. Such networks are growing so fast that it is essential to design algorithms to work for these large networks. Graph algorithms comprise an area in computer science that works to design efficient algorithms for networks. Here one can work on theoretical or practical problems where implementation of an algorithm for large networks is needed. In two of the chapters, recent results in graph matching games and fixed parameter tractability are surveyed. Combinatorial optimization is an intersection of operations research and mathematics, especially discrete mathematics, which deals with new questions and new problems, attempting to find an optimum object from a finite set of objects. Most problems in combinatorial optimization are not tractable (i.e., NP-hard). Therefore it is necessary to design an approximation algorithm for them. To tackle these problems requires the development and combination of ideas and techniques from diverse mathematical areas including complexity theory, algorithm theory, and matroids as well as graph theory, combinatorics, convex and nonlinear optimization, and discrete and convex geometry. Overall, the book presents recent progress in facility location, network design, and discrete convex analysis.

Gems of Combinatorial Optimization and Graph Algorithms - Andreas S. Schulz 2016-01-31
Are you looking for new lectures for your course on algorithms, combinatorial optimization, or algorithmic game theory? Maybe you need a convenient source of relevant, current topics for a graduate student or advanced undergraduate student seminar? Or perhaps you just want an enjoyable look at some beautiful mathematical and algorithmic results, ideas, proofs, concepts, and techniques in discrete mathematics and theoretical computer science? Gems of Combinatorial Optimization and Graph Algorithms is a handpicked collection of up-to-date articles, carefully prepared by a select group of international experts, who have contributed some of their most mathematically or algorithmically elegant ideas. Topics include longest tours and Steiner trees in geometric spaces, cartograms, resource buying games, congestion games, selfish routing, revenue equivalence and shortest paths, scheduling, linear

structures in graphs, contraction hierarchies, budgeted matching problems, and motifs in networks. This volume is aimed at readers with some familiarity of combinatorial optimization, and appeals to researchers, graduate students, and advanced undergraduate students alike.

Exact Exponential Algorithms - Fedor V. Fomin 2010-10-26
For a long time computer scientists have distinguished between fast and slow algo rithms. Fast (or good) algorithms are the algorithms that run in polynomial time, which means that the number of steps required for the algorithm to solve a problem is bounded by some polynomial in the length of the input. All other algorithms are slow (or bad). The running time of slow algorithms is usually exponential. This book is about bad algorithms. There are several reasons why we are interested in exponential time algorithms. Most of us believe that there are many natural problems which cannot be solved by polynomial time algorithms. The most famous and oldest family of hard problems is the family of NP complete problems. Most likely there are no polynomial time al gorithms solving these hard problems and in the worst case scenario the exponential running time is unavoidable. Every combinatorial problem is solvable in ?nite time by enumerating all possi ble solutions, i. e. by brute force search. But is brute force search always unavoid able? De?nitely not. Already in the nineteen sixties and seventies it was known that some NP complete problems can be solved signi?cantly faster than by brute force search. Three classic examples are the following algorithms for the TRAVELLING SALESMAN problem, MAXIMUM INDEPENDENT SET, and COLORING.

Combinatorial Algorithms - T. C. Hu 2012-04-26
This updated edition presents algorithms for shortest paths, maximum flows, dynamic programming and backtracking. Also discusses binary trees, heuristic and near optimums, matrix multiplication, and NP-complete problems. Includes 153 black-and-white illustrations and 23 tables.

Combinatorics of Permutations - Miklos Bona 2004-06-25
WINNER of a CHOICE Outstanding Academic Title Award for 2006! As

linear orders, as elements of the symmetric group, modeled by matrices, modeled by graphspermutations are omnipresent in modern combinatorics. They are omnipresent but also multifaceted, and while several excellent books explore particular aspects of the subject, no one book h

Combinatorics - Peter J. Cameron 1994-10-06
Combinatorics is a subject of increasing importance, owing to its links with computer science, statistics and algebra. This is a textbook aimed at second-year undergraduates to beginning graduates. It stresses common techniques (such as generating functions and recursive construction) which underlie the great variety of subject matter and also stresses the fact that a constructive or algorithmic proof is more valuable than an existence proof. The book is divided into two parts, the second at a higher level and with a wider range than the first. Historical notes are included which give a wider perspective on the subject. More advanced topics are given as projects and there are a number of exercises, some with solutions given.

Combinatorics for Computer Science - Stanley Gill Williamson 2002-01-01
Useful guide covers two major subdivisions of combinatorics — enumeration and graph theory — with emphasis on conceptual needs of computer science. Each part is divided into a "basic concepts" chapter emphasizing intuitive needs of the subject, followed by four "topics" chapters that explore these ideas in depth. Invaluable practical resource for graduate students, advanced undergraduates, and professionals with an interest in algorithm design and other aspects of computer science and combinatorics. References for Linear Order & for Graphs, Trees, and Recursions. 219 figures.

A Course in Combinatorics - J. H. van Lint 2001-11-22
This is the second edition of a popular book on combinatorics, a subject dealing with ways of arranging and distributing objects, and which involves ideas from geometry, algebra and analysis. The breadth of the theory is matched by that of its applications, which include topics as diverse as codes, circuit design and algorithm complexity. It has thus

become essential for workers in many scientific fields to have some familiarity with the subject. The authors have tried to be as comprehensive as possible, dealing in a unified manner with, for example, graph theory, extremal problems, designs, colorings and codes. The depth and breadth of the coverage make the book a unique guide to the whole of the subject. The book is ideal for courses on combinatorical mathematics at the advanced undergraduate or beginning graduate level. Working mathematicians and scientists will also find it a valuable introduction and reference.

An Introduction to the Analysis of Algorithms - Robert Sedgewick 2013-01-18
Despite growing interest, basic information on methods and models for mathematically analyzing algorithms has rarely been directly accessible to practitioners, researchers, or students. An Introduction to the Analysis of Algorithms, Second Edition, organizes and presents that knowledge, fully introducing primary techniques and results in the field. Robert Sedgewick and the late Philippe Flajolet have drawn from both classical mathematics and computer science, integrating discrete mathematics, elementary real analysis, combinatorics, algorithms, and data structures. They emphasize the mathematics needed to support scientific studies that can serve as the basis for predicting algorithm performance and for comparing different algorithms on the basis of performance. Techniques covered in the first half of the book include recurrences, generating functions, asymptotics, and analytic combinatorics. Structures studied in the second half of the book include permutations, trees, strings, tries, and mappings. Numerous examples are included throughout to illustrate applications to the analysis of algorithms that are playing a critical role in the evolution of our modern computational infrastructure. Improvements and additions in this new edition include Upgraded figures and code An all-new chapter introducing analytic combinatorics Simplified derivations via analytic combinatorics throughout The book's thorough, self-contained coverage will help readers appreciate the field's challenges, prepare them for advanced results—covered in their monograph Analytic Combinatorics and in Donald Knuth's The Art of

Computer Programming books—and provide the background they need to keep abreast of new research. "[Sedgewick and Flajolet] are not only worldwide leaders of the field, they also are masters of exposition. I am sure that every serious computer scientist will find this book rewarding in many ways." —From the Foreword by Donald E. Knuth

Matters Computational - Jörg Arndt 2010-10-01
This book provides algorithms and ideas for computationalists. Subjects treated include low-level algorithms, bit wizardry, combinatorial generation, fast transforms like the Fourier transform, and fast arithmetic for both real numbers and finite fields. Various optimization techniques are described and the actual performance of many given implementations is examined. The focus is on material that does not usually appear in textbooks on algorithms. The implementations are done in C++ and the GP language, written for POSIX-compliant platforms such as the Linux and BSD operating systems.

Topics in Combinatorial Group Theory - Gilbert Baumslag 2012-12-06
Combinatorial group theory is a loosely defined subject, with close connections to topology and logic. With surprising frequency, problems in a wide variety of disciplines, including differential equations, automorphic functions and geometry, have been distilled into explicit questions about groups, typically of the following kind: Are the groups in a given class finite (e.g., the Burnside problem)? Finitely generated? Finitely presented? What are the conjugates of a given element in a given group? What are the subgroups of that group? Is there an algorithm for deciding for every pair of groups in a given class whether they are isomorphic or not? The objective of combinatorial group theory is the systematic development of algebraic techniques to settle such questions. In view of the scope of the subject and the extraordinary variety of groups involved, it is not surprising that no really general theory exists. These notes, bridging the very beginning of the theory to new results and developments, are devoted to a number of topics in combinatorial group theory and serve as an introduction to the subject on the graduate level.

Analytic Combinatorics - Philippe Flajolet 2009-01-15
Analytic combinatorics aims to enable precise quantitative predictions of the properties of large combinatorial structures. The theory has emerged over recent decades as essential both for the analysis of algorithms and for the study of scientific models in many disciplines, including probability theory, statistical physics, computational biology, and information theory. With a careful combination of symbolic enumeration methods and complex analysis, drawing heavily on generating functions, results of sweeping generality emerge that can be applied in particular to fundamental structures such as permutations, sequences, strings, walks, paths, trees, graphs and maps. This account is the definitive treatment of the topic. The authors give full coverage of the underlying mathematics and a thorough treatment of both classical and modern applications of the theory. The text is complemented with exercises, examples, appendices and notes to aid understanding. The book can be used for an advanced undergraduate or a graduate course, or for self-study.

Algorithms on Trees and Graphs - Gabriel Valiente 2013-04-17
Graph algorithms is a well-established subject in mathematics and computer science. Beyond classical application fields, such as approximation, combinatorial optimization, graphics, and operations research, graph algorithms have recently attracted increased attention from computational molecular biology and computational chemistry. Centered around the fundamental issue of graph isomorphism, this text goes beyond classical graph problems of shortest paths, spanning trees, flows in networks, and matchings in bipartite graphs. Advanced algorithmic results and techniques of practical relevance are presented in a coherent and consolidated way. This book introduces graph algorithms on an intuitive basis followed by a detailed exposition in a literate programming style, with correctness proofs as well as worst-case analyses. Furthermore, full C++ implementations of all algorithms presented are given using the LEDA library of efficient data structures and algorithms.

Counting: The Art of Enumerative Combinatorics - George E. Martin 2013-03-09
This book provides an introduction to discrete mathematics. At the end of

the book the reader should be able to answer counting questions such as: How many ways are there to stack n poker chips, each of which can be red, white, blue, or green, such that each red chip is adjacent to at least 1 green chip? The book can be used as a textbook for a semester course at the sophomore level. The first five chapters can also serve as a basis for a graduate course for in-service teachers.

Combinatorial Algebraic Topology - Dimitry Kozlov 2008-01-08
This volume is the first comprehensive treatment of combinatorial algebraic topology in book form. The first part of the book constitutes a swift walk through the main tools of algebraic topology. Readers - graduate students and working mathematicians alike - will probably find particularly useful the second part, which contains an in-depth discussion of the major research techniques of combinatorial algebraic topology. Although applications are sprinkled throughout the second part, they are principal focus of the third part, which is entirely devoted to developing the topological structure theory for graph homomorphisms.

Aspects of Combinatorics - Victor Bryant 1993-01-14
Combinatorics is a broad and important area of mathematics, and this textbook provides the beginner with the ideal introduction to many of the different aspects of the subject.

Algorithms and Programming - Alexander Shen 2008-01-11
"Primarily intended for a first-year undergraduate course in programming"--Page 4 of cover.

Combinatorial Algorithms - Donald L. Kreher 2020-09-24
This textbook thoroughly outlines combinatorial algorithms for generation, enumeration, and search. Topics include backtracking and heuristic search methods applied to various combinatorial structures, such as: Combinations Permutations Graphs Designs Many classical areas are covered as well as new research topics not included in most existing texts, such as: Group algorithms Graph isomorphism Hill-climbing Heuristic search algorithms This work serves as an exceptional textbook for a modern course in combinatorial algorithms, providing a unified and focused collection of recent topics of interest in the area. The authors, synthesizing material that can only be found scattered through

many different sources, introduce the most important combinatorial algorithmic techniques - thus creating an accessible, comprehensive text that students of mathematics, electrical engineering, and computer science can understand without needing a prior course on combinatorics.

Handbook of Graph Theory, Combinatorial Optimization, and Algorithms - Krishnaiyan "KT" Thulasiraman 2016-01-05
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

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

Permutation Groups - Peter J. Cameron 1999-02-04
This book summarizes recent developments in the study of permutation groups for beginning graduate students.