A First Course in Discrete Mathematics

Combinatorial enumeration is a readily accessible subject full of easily stated, but sometimes tantalizingly difficult problems. This book leads the reader in a leisurely way from basic notions of combinatorial enumeration to a variety of topics, ranging from algebra to statistical physics. The book is organized in three parts: Basics, Methods, and Topics. The aim is to introduce readers to a fascinating field, and to offer a sophisticated source of information for professional mathematicians desiring to learn more. There are 666 exercises, and every chapter ends with a highlight section, discussing in detail a particularly beautiful or famous result.

Principles of Combinatorics

As a student moves from basic calculus courses into upper-division courses in linear and abstract algebra, real and complex analysis, number theory, topology, and so on, a “bridge” course can help ensure a smooth transition. Introduction to Mathematical Structures and Proofs is a textbook intended for such a course, or for self-study. This book introduces an array of fundamental mathematical structures. It also explores the delicate balance of intuition and rigor—and the flexible thinking—required to prove a nontrivial result. In short, this book seeks to enhance the mathematical maturity of the reader. The new material in this second edition includes a section on graph theory, several new sections on number theory (including primitive roots, with an application to card-shuffling), and a brief introduction to the complex numbers (including a section on the arithmetic of the Gaussian integers). Solutions for even numbered exercises are available on springer.com for instructors adopting the text for a course.

A Path to Combinatorics for Undergraduates

A study of combinatorics—formulas used in solving problems that ask how many

Discrete Mathematics with Applications

Pioneered by American economist Paul Samuelson, revealed preference theory is based on the idea that the preferences of consumers are revealed in their purchasing behavior. Researchers in this field have developed complex and sophisticated mathematical models to capture the preferences that are ‘revealed’ through consumer choice behavior. This study of consumer demand and behavior is closely tied up with econometrics (especially nonparametric econometrics), where testing the validity of different theoretical models is an important aspect of research. The theory of revealed preference has a very long and distinguished tradition in economics, but there was no systematic presentation of the theory until now. This book deals with basic questions in economic theory, such as the relation between theory and data, and studies the situations in which empirical observations are consistent or inconsistent with some of the best known theories in economics.

Introduction to Probability with R

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Introductory, Combinatorics, Third Edition is designed for introductory courses in combinatorics, or more generally, discrete mathematics. The author, Kenneth Bogart, has chosen core material of value to students in a wide variety of disciplines: mathematics, computer science, statistics, operations research, physical sciences, and behavioral sciences. The rapid growth in the breadth and depth of the field of combinatorics in the last several decades, first in graph theory and designs and more recently in enumeration and ordered sets, has led to a recognition of combinatorics as a field with which the aspiring mathematician should become familiar. This long-overdue new edition of a popular set presents a broad comprehensive survey of modern combinatorics which is important to the various scientific fields of study.

**Combinatorics: The Art of Counting**

This unique approach to combinatorics is centered around unconventional, essay-type combinatorial examples, followed by a number of carefully selected, challenging problems and extensive discussions of their solutions. Topics encompass permutations and combinations, binomial coefficients and their applications, bijections, inclusions and exclusions, and generating functions. Each chapter features fully-worked problems, including many from Olympiads and other competitions, as well as a number of problems original to the authors; at the end of each chapter are further exercises to reinforce understanding, encourage creativity, and build a repertory of problem-solving techniques. The authors' previous text, "102 Combinatorial Problems," makes a fine companion volume to the present work, which is ideal for Olympiad participants and coaches, advanced high school students, undergraduates, and college instructors. The book's unusual problems and examples will interest seasoned mathematicians as well. *A Path to Combinatorics for Undergraduates* is a lively introduction not only to combinatorics, but to mathematical ingenuity, rigor, and the joy of solving puzzles.

**Mathematics for Computer Science**

In this revised text, master expositor Sheldon Ross has produced a unique work in introductory statistics. The text's main merits are the clarity of presentation, contemporary examples and applications from diverse areas, and an explanation of intuition and ideas behind the statistical methods. To quote from the preface, "It is only when a student develops a feel or intuition for statistics that she or he is really on the path toward making sense of data." Ross achieves this goal through a coherent mix of mathematical analysis, intuitive discussions and examples. Ross's clear writing style leads students easily through descriptive and inferential statistics * Hundreds of exercises assess students' conceptual and computational understanding * Real data sets from current issues draw from a variety of disciplines * Statistics in Perspective highlights demonstrate real-world application of techniques and concepts * Historical Perspectives sections profile prominent statisticians and events * Chapter Introductions pose realistic statistical situations * Chapter Summaries and Key Terms reinforce learning * A computerized test bank, plus updates to other ancillaries Ancillaries: * Instructor's Manual * Student Solutions Manual (ISBN: 0120885514) * Printed Test Bank * Computerized Test Bank * Instructor's web site with additional online materials

**Classes of Directed Graphs**

Master the fundamentals of discrete mathematics with DISCRETE MATHEMATICS FOR COMPUTER SCIENCE with Student Solutions Manual CD-ROM! An increasing number of computer scientists from diverse areas are using discrete mathematical structures to explain concepts and problems and this mathematics text shows you how to express precise ideas in clear mathematical language. Through a wealth of exercises and examples, you will learn how mastering discrete mathematics will help you develop important reasoning skills that will continue to be useful throughout your career.

**Discrete Calculus**

This text is intended as an introduction to mathematical proofs for students. It is distilled from the lecture notes for a course focused on set theory subject matter as a means of teaching proofs. Chapter 1 contains an introduction and provides a brief summary of some background material students may be unfamiliar with. Chapters 2 and 3 introduce the basics of logic for students not yet familiar with these topics. Included is material on Boolean logic, propositions and predicates, logical operations, truth tables, tautologies and contradictions, rules of inference and logical arguments. Chapter 4 introduces mathematical proofs, including proof conventions, direct proofs, proof-by-contradiction, and proof-by-contraposition. Chapter 5 introduces the basics of naive set theory, including Venn diagrams and operations on sets. Chapter 6 introduces mathematical induction and recurrence relations. Chapter 7 introduces set-theoretic
functions and covers injective, surjective, and bijective functions, as well as permutations. Chapter 8 covers the fundamental properties of the integers including primes, unique factorization, and Euclid's algorithm. Chapter 9 is an introduction to combinatorics; topics included are combinatorial proofs, binomial and multinomial coefficients, the Inclusion-Exclusion principle, and counting the number of surjective functions between finite sets. Chapter 10 introduces relations and covers equivalence relations and partial orders. Chapter 11 covers number bases, number systems, and operations. Chapter 12 covers cardinality, including basic results on countable and uncountable infinities, and introduces cardinal numbers. Chapter 13 expands on partial orders and introduces ordinal numbers. Chapter 14 examines the paradoxes of naive set theory and introduces and discusses axiomatic set theory. This chapter also includes Cantor's Paradox, Russell's Paradox, a discussion of axiomatic theories, an exposition on Zermelo-Fraenkel Set Theory with the Axiom of Choice, and a brief explanation of Gödel's Incompleteness Theorems.

**Discrete Mathematics with Applications**

The purpose of this book is to introduce the basic ideas of mathematical proof to students embarking on university mathematics. The emphasis is on helping the reader in understanding and constructing proofs and writing clear mathematics. Over 250 problems include questions to interest and challenge the most able student but also plenty of routine exercises to help familiarize the reader with the basic ideas.

**Proofs that Really Count: The Art of Combinatorial Proof**

This book has been written according to the latest syllabi for B. Tech. & M.C.A. courses of Punjab Technical University and other technical universities of India. The previous years' university questions papers have been solved systematically and logically in each chapter. It is intended to help students better understand the concepts and ideas of discrete structures.

**Counting and Configurations**

Bijective proofs are some of the most elegant and powerful techniques in all of mathematics. Suitable for readers without prior background in algebra or combinatorics, Bijective Combinatorics presents a general introduction to enumerative and algebraic combinatorics that emphasizes bijective methods. The text systematically develops the mathematical tools, such as basic counting rules, recursions, inclusion-exclusion techniques, generating functions, bijective proofs, and linear-algebraic methods, needed to solve enumeration problems. These tools are used to analyze many combinatorial structures, including words, permutations, subsets, functions, compositions, integer partitions, graphs, trees, lattice paths, multisets, rook placements, set partitions, Eulerian tours, derangements, posets, tilings, and abaci. The book also delves into algebraic aspects of combinatorics, offering detailed treatments of formal power series, symmetric groups, group actions, symmetric polynomials, determinants, and the combinatorial calculus of tableaux. Each chapter includes summaries and extensive problem sets that review and reinforce the material. Lucid, engaging, yet fully rigorous, this text describes a host of combinatorial techniques to help solve complicated enumeration problems. It covers the basic principles of enumeration, giving due attention to the role of bijective proofs in enumeration theory.

**Introduction to Probability**

This is a graduate text introducing the fundamentals of measure theory and integration theory, which is the foundation of modern real analysis. The text focuses first on the concrete setting of Lebesgue measure and the Lebesgue integral (which in turn is motivated by the more classical concepts of Jordan measure and the Riemann integral), before moving on to abstract measure and integration theory, including the standard convergence theorems, Fubini's theorem, and the Carathéodory extension theorem. Classical differentiation theorems, such as the Lebesgue and Rademacher differentiation theorems, are also covered, as are connections with probability theory. The material is intended to cover a quarter or semester's worth of material for a first graduate course in real analysis. There is an emphasis in the text on tying together the abstract and the concrete sides of the subject, using the latter to illustrate and motivate the former. The central role of key principles (such as Littlewood's three principles) as providing guiding intuition to the subject is also emphasized. There are a large number of exercises throughout that develop key aspects of the theory, and are thus an integral component of the text. As a supplementary section, a discussion of general problem-solving strategies in analysis is also given. The last three sections discuss optional topics related to the main matter of the book.

**Principles and Techniques in Combinatorics**
This book covers elementary discrete mathematics for computer science and engineering. It emphasizes mathematical definitions and proofs as well as applicable methods. Topics include formal logic notation, proof methods; induction, well-ordering; sets, relations; elementary graph theory; integer congruences; asymptotic notation and growth of functions; permutations and combinations, counting principles; discrete probability. Further selected topics may also be covered, such as recursive definition and structural induction; state machines and invariants; recurrences; generating functions.

**Invitation to Discrete Mathematics**

This collection of surveys consists in part of extensions of papers presented at the conferences on convexity at the Technische Universitat Wien (July 1981) and at the Universitat Siegen (July 1982) and in part of articles written at the invitation of the editors. This volume together with the earlier volume Contributions to Geometry edited by Tolke and Wills and published by Birkhauser in 1979 should give a fairly good account of many of the more important facets of convexity and its applications. Besides being an up to date reference work this volume can be used as an advanced treatise on convexity and related fields. We sincerely hope that it will inspire future research. Fenchel, in his paper, gives an historical account of convexity showing many important but not so well known facets. The articles of Papini and Phelps relate convexity to problems of functional analysis on nearest points, nonexpansive maps and the extremal structure of convex sets. A bridge to mathematical physics in the sense of Polya and Szego is provided by the survey of Bandle on isoperimetric inequalities, and Bachem's paper illustrates the importance of convexity for optimization. The contribution of Coxeter deals with a classical topic in geometry, the lines on the cubic surface whereas Leichtweiss shows the close connections between convexity and differential geometry. The exhaustive survey of Chalk on point lattices is related to algebraic number theory. A topic important for applications in biology, geology etc.

**Essentials of Discrete Mathematics**

**Mathematics of Choice**

This book is a gentle introduction to the enumerative part of combinatorics suitable for study at the advanced undergraduate or beginning graduate level. In addition to covering all the standard techniques for counting combinatorial objects, the text contains material from the research literature which has never before appeared in print, such as the use of quotient posets to study the Möbius function and characteristic polynomial of a partially ordered set, or the connection between quasisymmetric functions and pattern avoidance. The book assumes minimal background, and a first course in abstract algebra should suffice. The exposition is very reader friendly: keeping a moderate pace, using lots of examples, emphasizing recurring themes, and frankly expressing the delight the author takes in mathematics in general and combinatorics in particular.

**Introductory Statistics**

Berge's Principles of Combinatorics is now an acknowledged classic work of the field. Complementary to his previous books, Berge's introduction deals largely with enumeration. The choice of topics is balanced, the presentation elegant, and the text can be followed by anyone with an interest in the subject with only a little algebra required as a background. Some topics were here described for the first time, including Robinson-Shensted theorem, the Eden-Schutzenberger theorem, and facts connecting Young diagrams, trees, and the symmetric group.

**Introduction to Mathematical Structures and Proofs**

Math—the application of reasonable logic to reasonable assumptions—usually produces reasonable results. But sometimes math generates astonishing paradoxes—conclusions that seem completely unreasonable or just plain impossible but that are nevertheless demonstrably true. Did you know that a losing sports team can become a winning one by adding worse players than its opponents? Or that the thirteenth of the month is more likely to be a Friday than any other day? Or that cones can roll unaided uphill? In Nonplussed!—a delightfully eclectic collection of paradoxes from many different areas of math—popular-math writer Julian Havil reveals the math that shows the truth of these and many other unbelievable ideas. Nonplussed! pays special attention to problems from probability and statistics, areas where intuition can easily be wrong. These problems include the vagaries of tennis scoring, what can be deduced from tossing a needle, and disadvantageous games that form winning combinations. Other chapters address everything from the historically important Torricelli's Trumpet to the mind-warping
implications of objects that live on high dimensions. Readers learn about the colorful history and people associated with many of these problems in addition to their mathematical proofs. Nonplussed! will appeal to anyone with a calculus background who enjoys popular math books or puzzles.

**An Introduction to Proofs with Set Theory**

A textbook suitable for undergraduate courses. The materials are presented very explicitly so that students will find it very easy to read. A wide range of examples, about 500 combinatorial problems taken from various mathematical competitions and exercises are also included.

**Combinatorics**

Invitation to Discrete Mathematics is an introduction and a thoroughly comprehensive text at the same time. A lively and entertaining style with mathematical precision and maturity uniquely combine into an intellectual happening and should delight the interested reader. A master example of teaching contemporary discrete mathematics, and of teaching science in general.

**Numbers and Proofs**

Probability is an area of mathematics of tremendous contemporary importance across all aspects of human endeavour. This book is a compact account of the basic features of probability and random processes at the level of first and second year mathematics undergraduates and Masters’ students in cognate fields. It is suitable for a first course in probability, plus a follow-up course in random processes including Markov chains. Three special features of this book are its modest size, the fairly broad range of topics covered, and its approach to mathematical rigour: not everything is rigorous, but the need for rigour is explained when necessary. This second edition develops the success of the first edition through an updated presentation, an extensive new chapter on Markov chains, and a number of new sections to ensure comprehensive coverage of the syllabi at major universities.

**Analytic Combinatorics**

Known for its accessible, precise approach, Epp’s DISCRETE MATHEMATICS WITH APPLICATIONS, 5th Edition, introduces discrete mathematics with clarity and precision. Coverage emphasizes the major themes of discrete mathematics as well as the reasoning that underlies mathematical thought. Students learn to think abstractly as they study the ideas of logic and proof. While learning about logic circuits and computer addition, algorithm analysis, recursive thinking, computability, automata, cryptography and combinatorics, students discover that ideas of discrete mathematics underlie and are essential to today’s science and technology. The author’s emphasis on reasoning provides a foundation for computer science and upper-level mathematics courses. Important Notice: Media content referenced within the product description or the product text may not be available in the ebook version.

**Discrete Mathematics for Computer Science**

Bridges combinatorics and probability and uniquely includes detailed formulas and proofs to promote mathematical thinking Combinatorics: An Introduction introduces readers to counting combinatorics, offers examples that feature unique approaches and ideas, and presents case-by-case methods for solving problems. Detailing how combinatorial problems arise in many areas of pure mathematics, most notably in algebra, probability theory, topology, and geometry, this book provides discussion on logic and paradoxes; sets and set notations; power sets and their cardinality; Venn diagrams; the multiplication principal; and permutations, combinations, and problems combining the multiplication principal. Additional features of this enlightening introduction include: Worked examples, proofs, and exercises in every chapter Detailed explanations of formulas to promote fundamental understanding Promotion of mathematical thinking by examining presented ideas and seeing proofs before reaching conclusions Elementary applications that do not advance beyond the use of Venn diagrams, the inclusion/exclusion formula, the multiplication principal, permutations, and combinations Combinatorics: An Introduction is an excellent book for discrete and finite mathematics courses at the upper-undergraduate level. This book is also ideal for readers who wish to better understand the various applications of elementary combinatorics.

**Introductory Combinatorics**

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This text is designed for an introductory probability course at the university level for sophomores, juniors, and seniors in mathematics, physical and social sciences, engineering, and computer science. It presents a thorough treatment of ideas and techniques necessary for a firm understanding of the subject. The text is also recommended for use in discrete probability courses. The material is organized so that the discrete and continuous probability discussions are presented in a separate, but parallel, manner. This organization does not emphasize an overly rigorous or formal view of probability and therefore offers some strong pedagogical value. Hence, the discrete discussions can sometimes serve to motivate the more abstract continuous probability discussions. Features: Key ideas are developed in a somewhat leisurely style, providing a variety of interesting applications to probability and showing some nonintuitive ideas. Over 600 exercises provide the opportunity for practicing skills and developing a sound understanding of ideas. Numerous historical comments deal with the development of discrete probability. The text includes many computer programs that illustrate the algorithms or the methods of computation for important problems. The book is a beautiful introduction to probability theory at the beginning level. The book contains a lot of examples and an easy development of theory without any sacrifice of rigor, keeping the abstraction to a minimal level. It is indeed a valuable addition to the study of probability theory. --Zentralblatt MATH

An Introduction to Measure Theory

This approachable text studies discrete objects and the relationships that bind them. It helps students understand and apply the power of discrete math to digital computer systems and other modern applications. It provides excellent preparation for courses in linear algebra, number theory, and modern/abstract algebra and for computer science courses in data structures, algorithms, programming languages, compilers, databases, and computation. * Covers all recommended topics in a self-contained, comprehensive, and understandable format for students and new professionals * Emphasizes problem-solving techniques, pattern recognition, conjecturing, induction, applications of varying nature, proof techniques, algorithm development and correctness, and numeric computations * Weaves numerous applications into the text * Helps students learn by doing with a wealth of examples and exercises: - 560 examples worked out in detail - More than 3,700 exercises - More than 150 computer assignments - More than 600 writing projects * Includes chapter summaries of important vocabulary, formulas, and properties, plus the chapter review exercises * Features interesting anecdotes and biographies of 60 mathematicians and computer scientists * Instructor's Manual available for adopters * Student Solutions Manual available separately for purchase (ISBN: 0124211828)

Book of Proof

According to the great mathematician Paul Erdős, God maintains perfect mathematical proofs in The Book. This book presents the authors candidates for such "perfect proofs," those which contain brilliant ideas, clever connections, and wonderful observations, bringing new insight and surprising perspectives to problems from number theory, geometry, analysis, combinatorics, and graph theory. As a result, this book will be fun reading for anyone with an interest in mathematics.

Improved Bonferroni Inequalities via Abstract Tubes

This book is an introduction to the language and standard proof methods of mathematics. It is a bridge from the computational courses (such as calculus or differential equations) that students typically encounter in their first year of college to a more abstract outlook. It lays a foundation for more theoretical courses such as topology, analysis and abstract algebra. Although it may be more meaningful to the student who has had some calculus, there is really no prerequisite other than a measure of mathematical maturity.

Revealed Preference Theory

Based on a popular course taught by the late Gian-Carlo Rota of MIT, with many new topics covered as well, Introduction to Probability with R presents R programs and animations to provide an intuitive yet rigorous understanding of how to model natural phenomena from a probabilistic point of view. Although the R programs are small in length, they are just as sophisticated and powerful as longer programs in other languages. This brevity makes it easy for students to become proficient in R. This calculus-based introduction organizes the material around key themes. One of the most important themes centers on viewing probability as a way to look at the world, helping students think and reason probabilistically. The text also shows how to combine and link stochastic processes to form more complex processes that are better models of natural phenomena. In addition, it presents a unified treatment of transforms, such as Laplace, Fourier, and z; the foundations of fundamental stochastic processes using entropy and information; and an introduction to Markov chains from various viewpoints. Each chapter includes a short biographical note about a contributor to probability theory, exercises, and selected answers. The book has an accompanying website with more information.
Parameterized Algorithms

This book presents methods of solving problems in three areas of elementary combinatorial mathematics: classical combinatorics, combinatorial arithmetic, and combinatorial geometry. Brief theoretical discussions are immediately followed by carefully worked-out examples of increasing degrees of difficulty and by exercises that range from routine to rather challenging. The book features approximately 310 examples and 650 exercises.

Combinatorics

Recipient of the Mathematical Association of America's Beckenbach Book Prize in 2006! Mathematics is the science of patterns, and mathematicians attempt to understand these patterns and discover new ones using a variety of tools. In Proofs That Really Count, award-winning math professors Arthur Benjamin and Jennifer Quinn demonstrate that many number patterns, even very complex ones, can be understood by simple counting arguments. The book emphasizes numbers that are often not thought of as numbers that count: Fibonacci Numbers, Lucas Numbers, Continued Fractions, and Harmonic Numbers, to name a few. Numerous hints and references are given for all chapter exercises and many chapters end with a list of identities in need of combinatorial proof. The extensive appendix of identities will be a valuable resource. This book should appeal to readers of all levels, from high school math students to professional mathematicians.

Proofs from THE BOOK

This text provides a theoretical background for several topics in combinatorial mathematics, such as enumerative combinatorics (including partitions and Burnside's lemma), magic and Latin squares, graph theory, extremal combinatorics, mathematical games and elementary probability. A number of examples are given with explanations while the book also provides more than 300 exercises of different levels of difficulty that are arranged at the end of each chapter, and more than 130 additional challenging problems, including problems from mathematical olympiads. Solutions or hints to all exercises and problems are included. The book can be used by secondary school students preparing for mathematical competitions, by their instructors, and by undergraduate students. The book may also be useful for graduate students and for researchers that apply combinatorial methods in different areas.

Combinatorial Reciprocity Theorems: An Invitation to Enumerative Geometric Combinatorics

This edited volume offers a detailed account of the theory of directed graphs from the perspective of important classes of digraphs, with each chapter written by experts on the topic. Outlining fundamental discoveries and new results obtained over recent years, this book provides a comprehensive overview of the latest research in the field. It covers core new results on each of the classes discussed, including chapters on tournaments, planar digraphs, acyclic digraphs, Euler digraphs, graph products, directed width parameters, and algorithms. Detailed indices ease navigation while more than 120 open problems and conjectures ensure that readers are immersed in all aspects of the field. Classes of Directed Graphs provides a valuable reference for graduate students and researchers in computer science, mathematics and operations research. As digraphs are an important modelling tool in other areas of research, this book will also be a useful resource to researchers working in bioinformatics, chemoinformatics, sociology, physics, medicine, etc.

Bijective Combinatorics

Combinatorial reciprocity is a very interesting phenomenon, which can be described as follows: A polynomial, whose values at positive integers count combinatorial objects of some sort, may give the number of combinatorial objects of a different sort when evaluated at negative integers (and suitably normalized). Such combinatorial reciprocity theorems occur in connections with graphs, partially ordered sets, polyhedra, and more. Using the combinatorial reciprocity theorems as a leitmotif, this book unfolds central ideas and techniques in enumerative and geometric combinatorics. Written in a friendly writing style, this is an accessible graduate textbook with almost 300 exercises, numerous illustrations, and pointers to the research literature. Topics include concise introductions to partially ordered sets, polyhedral geometry, and rational generating functions, followed by highly original chapters on subdivisions, geometric realizations of partially ordered sets, and hyperplane arrangements.

Discrete Structures
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.

An Introduction to Mathematical Reasoning

'Numbers and Proofs' presents a gentle introduction to the notion of proof to give the reader an understanding of how to decipher others' proofs as well as construct their own. Useful methods of proof are illustrated in the context of studying problems concerning mainly numbers (real, rational, complex and integers). An indispensable guide to all students of mathematics. Each proof is preceded by a discussion which is intended to show the reader the kind of thoughts they might have before any attempt proof is made. Established proofs which the student is in a better position to follow then follow. Presented in the author's entertaining and informal style, and written to reflect the changing profile of students entering universities, this book will prove essential reading for all seeking an introduction to the notion of proof as well as giving a definitive guide to the more common forms. Stressing the importance of backing up "truths" found through experimentation, with logically sound and watertight arguments, it provides an ideal bridge to more complex undergraduate maths.

Probability

This book provides an introduction to combinatorics, finite calculus, formal series, recurrences, and approximations of sums. Readers will find not only coverage of the basic elements of the subjects but also deep insights into a range of less common topics rarely considered within a single book, such as counting with occupancy constraints, a clear distinction between algebraic and analytical properties of formal power series, an introduction to discrete dynamical systems with a thorough description of Sarkovskii's theorem, symbolic calculus, and a complete description of the Euler-Maclaurin formulas and their applications. Although several books touch on one or more of these aspects, precious few cover all of them. The authors, both pure mathematicians, have attempted to develop methods that will allow the student to formulate a given problem in a precise mathematical framework. The aim is to equip readers with a sound strategy for classifying and solving problems by pursuing a mathematically rigorous yet user-friendly approach. This is particularly useful in combinatorics, a field where, all too often, exercises are solved by means of ad hoc tricks. The book contains more than 400 examples and about 300 problems, and the reader will be able to find the proof of every result. To further assist students and teachers, important matters and comments are highlighted, and parts that can be omitted, at least during a first and perhaps second reading, are identified.

Convexity and Its Applications

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.

Nonplussed!

Written for the one-term course, the Third Edition of Essentials of Discrete Mathematics is designed to serve computer science majors as well as students from a wide range of disciplines. The material is organized around five types of thinking: logical, relational, recursive, quantitative, and analytical. This presentation results in a coherent outline that steadily builds upon mathematical sophistication. Graphs are introduced early and referred to throughout the text, providing a richer context for examples and applications. Students will encounter algorithms near
the end of the text, after they have acquired the skills and experience needed to analyze them. The final chapter contains in-depth case studies from a variety of fields, including biology, sociology, linguistics, economics, and music.

A Course in Enumeration

Drawing on many years' experience of teaching discrete mathematics to students of all levels, Anderson introduces such aspects as enumeration, graph theory and configurations or arrangements. Starting with an introduction to counting and related problems, he moves on to the basic ideas of graph theory with particular emphasis on trees and planar graphs. He describes the inclusion-exclusion principle followed by partitions of sets which in turn leads to a study of Stirling and Bell numbers. Then follows a treatment of Hamiltonian cycles, Eulerian circuits in graphs, and Latin squares as well as proof of Hall's theorem. He concludes with the constructions of schedules and a brief introduction to block designs. Each chapter is backed by a number of examples, with straightforward applications of ideas and more challenging problems.

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