A Course In Mathematical Cryptography De Gruyter

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Algebra and Number Theory - Benjamin Fine 2017-09-11
This two-volume set collects and presents some fundamentals of mathematics in an entertaining and performing manner. The present volume examines many of the most important basic results in algebra and number theory, along with their proofs, and also their history. Contents The natural, integral and rational numbers Division and factorization in the integers Modular arithmetic Exceptional numbers Pythagorean triples and sums of squares Polynomials and

unique factorization Field extensions and splitting fields Permutations and symmetric polynomials Real numbers The complex numbers, the Fundamental Theorem of Algebra and polynomial equations Quadratic number fields and Pell's equation Transcendental numbers and the numbers e and π Compass and straightedge constructions and the classical problems Euclidean vector spaces

Algorithms and Classification in Combinatorial Group Theory - Gilbert Baumslag 2012-12-06

The papers in this volume are the result of a workshop held in January 1989 at the Mathematical Sciences Research Institute. Topics covered include decision problems, finitely presented simple groups, combinatorial geometry and homology, and automatic groups and related topics.

Selected Areas in Cryptography - Kaisa Nyberg 2003-07-01

This book constitutes the thoroughly refereed post-proceedings of the 9th Annual International Workshop on Selected Areas in Cryptology, SAC 2002, held in St. John's, Newfoundland, Canada, in August 2002. The 25 revised full papers presented were carefully selected from 90 submissions during two rounds of reviewing and improvement. The papers are organized in topical sections on elliptic curve enhancements, SNOW, encryption schemes, differential attacks, Boolean functions and stream ciphers, block cipher security, signatures and secret sharing, MAC and hash constructions, and RSA and XTR enhancements.

Cryptography for Secure Encryption - Robert G. Underwood 2022

This text is intended for a one-semester course in cryptography at the advanced undergraduate/Master's degree level. It is suitable for students from various STEM backgrounds, including engineering, mathematics, and computer science, and may also be attractive for researchers and professionals who want to learn the basics of

cryptography. Advanced knowledge of computer science or mathematics (other than elementary programming skills) is not assumed. The book includes more material than can be covered in a single semester. The Preface provides a suggested outline for a single semester course, though instructors are encouraged to select their own topics to reflect their specific requirements and interests. Each chapter contains a set of carefully written exercises which prompts review of the material in the chapter and expands on the concepts. Throughout the book, problems are stated mathematically, then algorithms are devised to solve the problems. Students are tasked to write computer programs (in C++ or GAP) to implement the algorithms. The use of programming skills to solve practical problems adds extra value to the use of this text. This book combines mathematical theory with practical applications to computer information systems. The fundamental concepts of classical and modern cryptography are discussed in relation to probability theory, complexity theory, modern algebra, and number theory. An overarching theme is cyber security: security of the cryptosystems and the key generation and distribution protocols, and methods of cryptanalysis (i.e., code breaking). It contains chapters on probability theory, information theory and entropy, complexity theory, and the algebraic and number theoretic foundations of cryptography. The book then reviews symmetric key cryptosystems, and discusses one-way trap door functions and public key cryptosystems including RSA and ElGamal. It contains a chapter on digital signature schemes, including material on message authentication and forgeries, and chapters on key generation and distribution. It contains a chapter on elliptic curve cryptography, including new material on the relationship between singular curves, algebraic groups and Hopf algebras.

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.

Foundations of Software Technology and Theoretical Computer Science - P.S. Thiagarajan 1995-12-04

This book constitutes the refereed proceedings of the 15th International Conference on Foundations of Software Technology and Theoretical Computer Science, FSTTCS '95, held in Bangalore, India in December 1995. The volume presents 31 full revised research papers selected from a total of 106 submissions together with full papers of four invited talks. Among the topics covered are algorithms, software technology, functional programming theory, distributed algorithms, term rewriting and constraint logic programming, complexity theory, process algebras, computational geometry, and temporal logics and verification theory.

Mathematical Principles of the Internet, Two Volume Set - Nirdosh Bhatnagar 2019-03-18
This two-volume set on Mathematical Principles of the Internet provides a comprehensive overview of the mathematical principles of Internet engineering. The books do not aim to provide all of the mathematical foundations upon which the Internet is based. Instead, these cover only a partial panorama and the key principles. Volume 1 explores Internet engineering, while the supporting mathematics is covered in Volume 2. The chapters on mathematics complement those on the engineering episodes, and an effort has been made to make this work succinct, yet self-contained. Elements of information theory, algebraic coding theory, cryptography, Internet traffic, dynamics and control of Internet congestion, and queueing theory are discussed. In addition, stochastic networks, graph-theoretic algorithms, application of game theory to the Internet, Internet economics, data mining and knowledge discovery, and quantum computation, communication, and cryptography are also discussed. In order to study the structure and function of the Internet, only a basic knowledge of number theory, abstract algebra, matrices and determinants, graph theory, geometry, analysis, optimization theory, probability theory, and stochastic processes, is required. These mathematical disciplines are defined and developed in the books to the extent that is needed to develop and justify their application to Internet engineering.

Nine Algorithms That Changed the Future - John MacCormick 2020-09-15
Nine revolutionary algorithms that power our computers and smartphones Every day, we use our computers to perform remarkable feats. A simple web search picks out a handful of relevant needles from the world's biggest haystack. Uploading a photo to Facebook transmits millions of pieces of information over numerous error-prone network links, yet

somehow a perfect copy of the photo arrives intact. Without even knowing it, we use public-key cryptography to transmit secret information like credit card numbers, and we use digital signatures to verify the identity of the websites we visit. How do our computers perform these tasks with such ease? John MacCormick answers this question in language anyone can understand, using vivid examples to explain the fundamental tricks behind nine computer algorithms that power our PCs, tablets, and smartphones.

International Symposium on Mathematics, Quantum Theory, and Cryptography - Tsuyoshi Takagi 2020-10-22

This open access book presents selected papers from International Symposium on Mathematics, Quantum Theory, and Cryptography (MQC), which was held on September 25-27, 2019 in Fukuoka, Japan. The international symposium MQC addresses the mathematics and quantum theory underlying secure modeling of the post quantum cryptography including e.g. mathematical study of the light-matter interaction models as well as quantum computing. The security of the most widely used RSA cryptosystem is based on the difficulty of factoring large integers. However, in 1994 Shor proposed a quantum polynomial time algorithm for factoring integers, and the RSA cryptosystem is no longer secure in the quantum computing model. This vulnerability has prompted research into post-quantum cryptography using alternative mathematical problems that are secure in the era of quantum computers. In this regard, the National Institute of Standards and Technology (NIST) began to standardize post-quantum cryptography in 2016. This book is suitable for postgraduate students in mathematics and computer science, as well as for experts in industry working on post-quantum cryptography.

Advances in Cryptology - 2003

Products of Finite Groups - Adolfo Ballester-Bolinches 2010-10-19

The study of finite groups factorised as a product of two or more subgroups has become a subject of great interest during the last years with applications not only in group theory, but also in other areas like cryptography and coding theory. It has experienced a big impulse with the introduction of some permutability conditions. The aim of this book is to gather, order, and examine part of this material, including the latest advances made, give some new approach to some topics, and present some new subjects of research in the theory of finite factorised groups.

Abstract Algebra - Celine Carstensen-Opitz 2019-09-02

A new approach to conveying abstract algebra, the area that studies algebraic structures, such as groups, rings, fields, modules, vector spaces, and algebras, that is essential to various scientific disciplines such as particle physics and cryptology. It provides a well written account of the theoretical foundations and it also includes a chapter on cryptography. End of chapter problems help readers with accessing the subjects.

Number Theory for Beginners - Andre Weil 2012-12-06

In the summer quarter of 1949, I taught a ten-weeks introductory course on number theory at the University of Chicago; it was announced in the catalogue as "Alge bra 251". What made it possible, in the form which I had planned for it, was the fact that Max Rosenlicht, now of the University of California at Berkeley, was then my assistant. According to his recollection, "this was the first and last time, in the his tory of the Chicago department of mathematics, that an assistant worked for his salary". The course consisted of two lectures a week, supplemented by a weekly "laboratory period" where students were given exercises which they were. asked to solve under Max's supervision and (when

necessary) with his help. This idea was borrowed from the "Praktikum" of German universi ties. Being alien to the local tradition, it did not work out as well as I had hoped, and student attendance at the problem sessions so on became desultory. v vi Weekly notes were written up by Max Rosenlicht and issued week by week to the students. Rather than a literal reproduction of the course, they should be regarded as its skeleton; they were supplemented by references to stan dard text-books on algebra. Max also contributed by far the larger part of the exercises. None of ,this was meant for publication.

Inside Finite Elements - Martin Weiser 2016-05-10

All relevant implementation aspects of finite element methods are discussed in this book. The focus is on algorithms and data structures as well as on their concrete implementation. Theory is covered only as far as it gives insight into the construction of algorithms. In the exercises, a complete FE-solver for stationary 2D problems is implemented in Matlab/Octave. Contents: Finite Element Fundamentals Grids and Finite Elements Assembly Solvers Error Estimation Mesh Refinement Multigrid Elastomechanics Fluid Mechanics Grid Data Structure Function Reference

A Course in Mathematical Cryptography - Gilbert Baumslag 2015-06-16

The subject of this book is mathematical cryptography. By this we mean the mathematics involved in cryptographic protocols. As the field has expanded, using both commutative and noncommutative algebraic objects as cryptographic platforms, a book describing and explaining all these mathematical methods is of immeasurable value.

Cryptographic Engineering - Cetin Kaya Koc 2008-12-11

This book is for engineers and researchers working in the embedded hardware industry. This book addresses the design aspects of

cryptographic hardware and embedded software. The authors provide tutorial-type material for professional engineers and computer information specialists.

Modern Computer Arithmetic - Richard P. Brent 2010-11-25

Modern Computer Arithmetic focuses on arbitrary-precision algorithms for efficiently performing arithmetic operations such as addition, multiplication and division, and their connections to topics such as modular arithmetic, greatest common divisors, the Fast Fourier Transform (FFT), and the computation of elementary and special functions. Brent and Zimmermann present algorithms that are ready to implement in your favourite language, while keeping a high-level description and avoiding too low-level or machine-dependent details. The book is intended for anyone interested in the design and implementation of efficient high-precision algorithms for computer arithmetic, and more generally efficient multiple-precision numerical algorithms. It may also be used in a graduate course in mathematics or computer science, for which exercises are included. These vary considerably in difficulty, from easy to small research projects, and expand on topics discussed in the text. Solutions to selected exercises are available from the authors.

Advances in Cryptology -- EUROCRYPT 2003 - EUROCRYPT. 2003-04-22

This book constitutes the refereed proceedings of the International Conference on the Theory and Applications of Cryptographic Techniques, EUROCRYPT 2003, held in Warsaw, Poland in May 2003. The 37 revised full papers presented together with two invited papers were carefully reviewed and selected from 156 submissions. The papers are organized in topical sections on cryptanalysis, secure multi-party communication, zero-knowledge protocols, foundations and complexity-theoretic security, public key encryption, new primitives, elliptic curve cryptography, digital signatures,

information-theoretic cryptography, and group signatures.

Abstract Algebra - Celine Carstensen-Opitz 2019-09-02

A new approach to conveying abstract algebra, the area that studies algebraic structures, such as groups, rings, fields, modules, vector spaces, and algebras, that is essential to various scientific disciplines such as particle physics and cryptology. It provides a well written account of the theoretical foundations and it also includes a chapter on cryptography. End of chapter problems help readers with accessing the subjects.

Mathematical Principles of the Internet, Volume 2 - Nirdosh Bhatnagar 2018-11-21

This two-volume set on Mathematical Principles of the Internet provides a comprehensive overview of the mathematical principles of Internet engineering. The books do not aim to provide all of the mathematical foundations upon which the Internet is based. Instead, they cover a partial panorama and the key principles. Volume 1 explores Internet engineering, while the supporting mathematics is covered in Volume 2. The chapters on mathematics complement those on the engineering episodes, and an effort has been made to make this work succinct, yet self-contained. Elements of information theory, algebraic coding theory, cryptography, Internet traffic, dynamics and control of Internet congestion, and queueing theory are discussed. In addition, stochastic networks, graph-theoretic algorithms, application of game theory to the Internet, Internet economics, data mining and knowledge discovery, and quantum computation, communication, and cryptography are also discussed. In order to study the structure and function of the Internet, only a basic knowledge of number theory, abstract algebra, matrices and determinants, graph theory, geometry, analysis, optimization theory, probability theory, and stochastic processes, is required. These

mathematical disciplines are defined and developed in the books to the extent that is needed to develop and justify their application to Internet engineering.

Oxford Users' Guide to Mathematics - Zeidler Eberhard 2004-08-19

The Oxford Users' Guide to Mathematics is one of the leading handbooks on mathematics available. It presents a comprehensive modern picture of mathematics and emphasises the relations between the different branches of mathematics, and the applications of mathematics in engineering and the natural sciences. The Oxford User's Guide covers a broad spectrum of mathematics starting with the basic material and progressing on to more advanced topics that have come to the fore in the last few decades. The book is organised into mathematical sub-disciplines including analysis, algebra, geometry, foundations of mathematics, calculus of variations and optimisation, theory of probability and mathematical statistics, numerical mathematics and scientific computing, and history of mathematics. The book is supplemented by numerous tables on infinite series, special functions, integrals, integral transformations, mathematical statistics, and fundamental constants in physics. It also includes a comprehensive bibliography of key contemporary literature as well as an extensive glossary and index. The wealth of material, reaching across all levels and numerous sub-disciplines, makes The Oxford User's Guide to Mathematics an invaluable reference source for students of engineering, mathematics, computer science, and the natural sciences, as well as teachers, practitioners, and researchers in industry and academia.

Elementary Theory of Groups and Group Rings, and Related Topics - Paul Baginski 2020-02-10

This proceedings volume documents the contributions presented at the conference held at Fairfield University and at the Graduate Center, CUNY in 2018 celebrating the New York

Group Theory Seminar, in memoriam Gilbert Baumslag, and to honor Benjamin Fine and Anthony Gaglione. It includes several expert contributions by leading figures in the group theory community and provides a valuable source of information on recent research developments.

Introduction to Cryptography - Hans Delfs 2015-09-29

The first part of this book covers the key concepts of cryptography on an undergraduate level, from encryption and digital signatures to cryptographic protocols. Essential techniques are demonstrated in protocols for key exchange, user identification, electronic elections and digital cash. In the second part, more advanced topics are addressed, such as the bit security of one-way functions and computationally perfect pseudorandom bit generators. The security of cryptographic schemes is a central topic. Typical examples of provably secure encryption and signature schemes and their security proofs are given. Though particular attention is given to the mathematical foundations, no special background in mathematics is presumed. The necessary algebra, number theory and probability theory are included in the appendix. Each chapter closes with a collection of exercises. In the second edition the authors added a complete description of the AES, an extended section on cryptographic hash functions, and new sections on random oracle proofs and public-key encryption schemes that are provably secure against adaptively-chosen-ciphertext attacks. The third edition is a further substantive extension, with new topics added, including: elliptic curve cryptography; Paillier encryption; quantum cryptography; the new SHA-3 standard for cryptographic hash functions; a considerably extended section on electronic elections and Internet voting; mix nets; and zero-knowledge proofs of shuffles. The book is appropriate for undergraduate and graduate students in computer science,

mathematics, and engineering.

Algebraic Geometry in Coding Theory and Cryptography - Harald Niederreiter 2009-09-21

This textbook equips graduate students and advanced undergraduates with the necessary theoretical tools for applying algebraic geometry to information theory, and it covers primary applications in coding theory and cryptography. Harald Niederreiter and Chaoping Xing provide the first detailed discussion of the interplay between nonsingular projective curves and algebraic function fields over finite fields. This interplay is fundamental to research in the field today, yet until now no other textbook has featured complete proofs of it. Niederreiter and Xing cover classical applications like algebraic-geometry codes and elliptic-curve cryptosystems as well as material not treated by other books, including function-field codes, digital nets, code-based public-key cryptosystems, and frameproof codes. Combining a systematic development of theory with a broad selection of real-world applications, this is the most comprehensive yet accessible introduction to the field available. Introduces graduate students and advanced undergraduates to the foundations of algebraic geometry for applications to information theory Provides the first detailed discussion of the interplay between projective curves and algebraic function fields over finite fields Includes applications to coding theory and cryptography Covers the latest advances in algebraic-geometry codes Features applications to cryptography not treated in other books

Mathematical Principles of the Internet, Volume 1 - Nirdosh Bhatnagar 2018-11-20

This two-volume set on Mathematical Principles of the Internet provides a comprehensive overview of the mathematical principles of Internet engineering. The books do not aim to provide all of the mathematical foundations upon which the Internet is based. Instead, they cover a partial panorama and the key principles. Volume 1 explores Internet engineering, while

the supporting mathematics is covered in Volume 2. The chapters on mathematics complement those on the engineering episodes, and an effort has been made to make this work succinct, yet self-contained. Elements of information theory, algebraic coding theory, cryptography, Internet traffic, dynamics and control of Internet congestion, and queueing theory are discussed. In addition, stochastic networks, graph-theoretic algorithms, application of game theory to the Internet, Internet economics, data mining and knowledge discovery, and quantum computation, communication, and cryptography are also discussed. In order to study the structure and function of the Internet, only a basic knowledge of number theory, abstract algebra, matrices and determinants, graph theory, geometry, analysis, optimization theory, probability theory, and stochastic processes, is required. These mathematical disciplines are defined and developed in the books to the extent that is needed to develop and justify their application to Internet engineering.

Public-key Cryptography - Abhijit Das 2009

Public-key Cryptography provides a comprehensive coverage of the mathematical tools required for understanding the techniques of public-key cryptography and cryptanalysis. Key topics covered in the book include common cryptographic primitives and symmetric techniques, quantum cryptography, complexity theory, and practical cryptanalytic techniques such as side-channel attacks and backdoor attacks.Organized into eight chapters and supplemented with four appendices, this book is designed to be a self-sufficient resource for all students, teachers and researchers interested in the field of cryptography.

Topics in Infinite Group Theory - Benjamin Fine 2021-08-23

This book gives an advanced overview of several topics in infinite group theory. It can also be considered as a rigorous introduction to

combinatorial and geometric group theory. The philosophy of the book is to describe the interaction between these two important parts of infinite group theory. In this line of thought, several theorems are proved multiple times with different methods either purely combinatorial or purely geometric while others are shown by a combination of arguments from both perspectives. The first part of the book deals with Nielsen methods and introduces the reader to results and examples that are helpful to understand the following parts. The second part focuses on covering spaces and fundamental groups, including covering space proofs of group theoretic results. The third part deals with the theory of hyperbolic groups. The subjects are illustrated and described by prominent examples and an outlook on solved and unsolved problems.

Mathematical Reviews - 2003

Circuits and Systems for Security and Privacy - Farhana Sheikh 2017-12-19

Circuits and Systems for Security and Privacy begins by introducing the basic theoretical concepts and arithmetic used in algorithms for security and cryptography, and by reviewing the fundamental building blocks of cryptographic systems. It then analyzes the advantages and disadvantages of real-world implementations that not only optimize power, area, and throughput but also resist side-channel attacks. Merging the perspectives of experts from industry and academia, the book provides valuable insight and necessary background for the design of security-aware circuits and systems as well as efficient accelerators used in security applications.

Abstract Algebra - Celine Carstensen 2011

A new approach to conveying abstract algebra, the area that studies algebraic structures, such as groups, rings, fields, modules, vector spaces, and algebras, that is essential to various scientific disciplines such as particle physics and cryptology. It provides a well written account of

the theoretical foundations; also contains topics th

Computational and Statistical Group Theory - Esther G Forbes 2002

This book gives a nice overview of the diversity of current trends in computational and statistical group theory. It presents the latest research and a number of specific topics, such as growth, black box groups, measures on groups, product replacement algorithms, quantum automata, and more. It includes contributions by speakers at AMS Special Sessions at The University of Nevada (Las Vegas) and the Stevens Institute of Technology (Hoboken, NJ). It is suitable for graduate students and research mathematicians interested in group theory.

Elliptic Curves - Susanne Schmitt 2008-08-22

The basics of the theory of elliptic curves should be known to everybody, be he (or she) a mathematician or a computer scientist. Especially everybody concerned with cryptography should know the elements of this theory. The purpose of the present textbook is to give an elementary introduction to elliptic curves. Since this branch of number theory is particularly accessible to computer-assisted calculations, the authors make use of it by approaching the theory under a computational point of view. Specifically, the computer-algebra package SIMATH can be applied on several occasions. However, the book can be read also by those not interested in any computations. Of course, the theory of elliptic curves is very comprehensive and becomes correspondingly sophisticated. That is why the authors made a choice of the topics treated. Topics covered include the determination of torsion groups, computations regarding the Mordell-Weil group, height calculations, S-integral points. The contents is kept as elementary as possible. In this way it becomes obvious in which respect the book differs from the numerous textbooks on elliptic curves nowadays available.

Algebra and Computer Science - Delaram

Kahrobaei 2016-11-28

This volume contains the proceedings of three special sessions: Algebra and Computer Science, held during the Joint AMS-EMS-SPM meeting in Porto, Portugal, June 10–13, 2015; Groups, Algorithms, and Cryptography, held during the Joint Mathematics Meeting in San Antonio, TX, January 10–13, 2015; and Applications of Algebra to Cryptography, held during the Joint AMS-Israel Mathematical Union meeting in Tel-Aviv, Israel, June 16–19, 2014. Papers contained in this volume address a wide range of topics, from theoretical aspects of algebra, namely group theory, universal algebra and related areas, to applications in several different areas of computer science. From the computational side, the book aims to reflect the rapidly emerging area of algorithmic problems in algebra, their computational complexity and applications, including information security, constraint satisfaction problems, and decision theory. The book gives special attention to recent advances in quantum computing that highlight the need for a variety of new intractability assumptions and have resulted in a new area called group-based cryptography.

The Golden Ticket - Lance Fortnow 2017-02-28

The P-NP problem is the most important open problem in computer science, if not all of mathematics. Simply stated, it asks whether every problem whose solution can be quickly checked by computer can also be quickly solved by computer. The Golden Ticket provides a nontechnical introduction to P-NP, its rich history, and its algorithmic implications for everything we do with computers and beyond. Lance Fortnow traces the history and development of P-NP, giving examples from a variety of disciplines, including economics, physics, and biology. He explores problems that capture the full difficulty of the P-NP dilemma, from discovering the shortest route through all the rides at Disney World to finding large groups of friends on Facebook. The Golden Ticket

explores what we truly can and cannot achieve computationally, describing the benefits and unexpected challenges of this compelling problem.

Cryptography and Computational Number Theory - Kwok Y. Lam 2013-03-07

This volume contains the refereed proceedings of the Workshop on Cryptography and Computational Number Theory, CCNT'99, which has been held in Singapore during the week of November 22-26, 1999. The workshop was organized by the Centre for Systems Security of the Na tional University of Singapore. We gratefully acknowledge the financial support from the Singapore National Science and Technology Board under the grant num ber RP960668/M. The idea for this workshop grew out of the recognition of the recent, rapid development in various areas of cryptography and computational number the ory. The event followed the concept of the research programs at such well-known research institutions as the Newton Institute (UK), Oberwolfach and Dagstuhl (Germany), and Luminy (France). Accordingly, there were only invited lectures at the workshop with plenty of time for informal discussions. It was hoped and successfully achieved that the meeting would encourage and stimulate further research in information and computer security as well as in the design and implementation of number theoretic cryptosystems and other related areas. Another goal of the meeting was to stimulate collaboration and more active interaction between mathematicians, computer scientists, practical cryptographers and engineers in academia, industry and government.

An Invitation to Modern Number Theory - Steven J. Miller 2006-03-26

In a manner accessible to beginning undergraduates, An Invitation to Modern Number Theory introduces many of the central problems, conjectures, results, and techniques of the field, such as the Riemann Hypothesis,

Roth's Theorem, the Circle Method, and Random Matrix Theory. Showing how experiments are used to test conjectures and prove theorems, the book allows students to do original work on such problems, often using little more than calculus (though there are numerous remarks for those with deeper backgrounds). It shows students what number theory theorems are used for and what led to them and suggests problems for further research. Steven Miller and Ramin Takloo-Bighash introduce the problems and the computational skills required to numerically investigate them, providing background material (from probability to statistics to Fourier analysis) whenever necessary. They guide students through a variety of problems, ranging from basic number theory, cryptography, and Goldbach's Problem, to the algebraic structures of numbers and continued fractions, showing connections between these subjects and encouraging students to study them further. In addition, this is the first undergraduate book to explore Random Matrix Theory, which has recently become a powerful tool for predicting answers in number theory. Providing exercises, references to the background literature, and Web links to previous student research projects, An Invitation to Modern Number Theory can be used to teach a research seminar or a lecture class.

Discrete Algebraic Methods - Volker Diekert 2016-05-24

The idea behind this book is to provide the mathematical foundations for assessing modern developments in the Information Age. It deepens and complements the basic concepts, but it also considers instructive and more advanced topics. The treatise starts with a general chapter on algebraic structures; this part provides all the necessary knowledge for the rest of the book. The next chapter gives a concise overview of cryptography. Chapter 3 on number theoretic algorithms is important for developping cryptosystems, Chapter 4 presents the

deterministic primality test of Agrawal, Kayal, and Saxena. The account to elliptic curves again focuses on cryptographic applications and algorithms. With combinatorics on words and automata theory, the reader is introduced to two areas of theoretical computer science where semigroups play a fundamental role.The last chapter is devoted to combinatorial group theory and its connections to automata. Contents: Algebraic structures Cryptography Number theoretic algorithms Polynomial time primality test Elliptic curves Combinatorics on words Automata Discrete infinite groups

A Course in Mathematical Cryptography - Gilbert Baumslag 2015-06-16

Cryptography has become essential as bank transactions, credit card infor-mation, contracts, and sensitive medical information are sent through inse-cure channels. This book is concerned with the mathematical, especially algebraic, aspects of cryptography. It grew out of many courses presented by the authors over the past twenty years at various universities and covers a wide range of topics in mathematical cryptography. It is primarily geared towards graduate students and advanced undergraduates in mathematics and computer science, but may also be of interest to researchers in the area. Besides the classical methods of symmetric and private key encryption, the book treats the mathematics of cryptographic protocols and several unique topics such as Group-Based Cryptography Gröbner Basis Methods in Cryptography Lattice-Based Cryptography

Interactions between Group Theory, Symmetry and Cryptology - María Isabel González Vasco 2020-04-22

Cryptography lies at the heart of most technologies deployed today for secure communications. At the same time, mathematics lies at the heart of cryptography, as cryptographic constructions are based on algebraic scenarios ruled by group or number theoretical laws. Understanding the involved

algebraic structures is, thus, essential to design robust cryptographic schemes. This Special Issue is concerned with the interplay between group theory, symmetry and cryptography. The book highlights four exciting areas of research in which these fields intertwine: post-quantum cryptography, coding theory, computational group theory and symmetric cryptography. The articles presented demonstrate the relevance of rigorously analyzing the computational hardness of the mathematical problems used as a base for cryptographic constructions. For instance, decoding problems related to algebraic codes and rewriting problems in non-abelian groups are explored with cryptographic applications in mind. New results on the algebraic properties or symmetric cryptographic tools are also presented, moving ahead in the understanding of their security properties. In addition, post-quantum constructions for digital signatures and key exchange are explored in this Special Issue, exemplifying how (and how not) group theory may be used for developing robust cryptographic tools to withstand quantum attacks.

The Atlas of North American English - William Labov 2005-01-01

The Atlas of North American English provides the first overall view of the pronunciation and vowel systems of the dialects of the U.S. and Canada. The Atlas re-defines the regional dialects of American English on the basis of sound changes active in the 1990s and draws new boundaries reflecting those changes. It is based on a telephone survey of 762 local speakers, representing all the urbanized areas of North America. It has been developed by Bill Labov, one of the leading sociolinguists of the world, together with his colleagues Sharon Ash and Charles Boberg. The Atlas consists of a printed volume accompanied by an interactive CD-ROM. The print and multimedia content is also available online. Combined Edition: Book and Multimedia CD-ROM The book contains 23 chapters that re-define the geographic

boundaries of North American dialects and trace the influence of gender, age, education, and city size on the progress of sound change; findings that show a dramatic and increasing divergence of English in North America; 139 four color maps that illustrate the regional distribution of phonological and phonetic variables across the North American continent; 120 four color vowel charts of individual speakers. The multimedia CD-ROM supplements the articles and maps by providing a data base with measurements of more than 100,000 vowels and mean values for 439 speakers; the Plotnik program for mapping each of the individual vowel systems; extended sound samples of all North American dialects; multimedia applications to enhance classroom presentations. Online Version: Book and CD-ROM content plus additional data The online version comprises the contents of the book and the multimedia CD-ROM along with additional data. It presents a wider selection of data, maps, and audio samples that will be recurrently updated; proffers simultaneous access to the information contained in the book and on the multimedia CD-ROM to all users in the university/library network; provides students with easy access to research material for classroom assignments. For more information, please contact Mouton de Gruyter: customerservice@degruyter.com System Requirements for CD-ROM and Online Version Windows PC: Pentium PC, Windows 9x, NT, or XP, at least 16MB RAM, CD-ROM Drive, 16 Bit Soundcard, SVGA (600 x 800 resolution) Apple MAC: OS 6 or higher, 16 Bit Soundcard, at least 16MB RAM Supported Browsers: Internet Explorer, 5.5 or 6 (Mac OS: Internet Explorer 5.1)/Netscape 7.x or higher/Mozilla 1.0 or higher/Mozilla Firefox 1.0 or higher PlugIns: Macromedia Flash Player 6/Acrobat Reader