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Applied Algebra

Codes, Ciphers and Discrete Algorithms, Second Edition

CRC Press *Using mathematical tools from number theory and finite fields, Applied Algebra: Codes, Ciphers, and Discrete Algorithms, Second Edition presents practical methods for solving problems in data security and data integrity. It is designed for an applied algebra course for students who have had prior classes in abstract or linear algebra. While the content has been reworked and improved, this edition continues to cover many algorithms that arise in cryptography and error-control codes. New to the Second Edition A CD-ROM containing an interactive version of the book that is powered by Scientific Notebook®, a mathematical word processor and easy-to-use computer algebra system New appendix that reviews prerequisite topics in algebra and number theory Double the number of exercises Instead of a general study on finite groups, the book considers finite groups of permutations and develops just enough of the theory of finite fields to facilitate construction of the fields used for error-control codes and the Advanced Encryption Standard. It also deals with integers and polynomials. Explaining the mathematics as needed, this text thoroughly explores how mathematical techniques can be used to solve practical problems. About the Authors Darel W. Hardy is Professor Emeritus in the Department of Mathematics at Colorado State University. His research interests include applied algebra and semigroups. Fred Richman is a professor in the Department of Mathematical Sciences at Florida Atlantic University. His research interests include Abelian group theory and constructive mathematics. Carol L. Walker is Associate Dean Emeritus in the Department of Mathematical Sciences at New Mexico State University. Her research interests include Abelian group theory, applications of homological algebra and category theory, and the mathematics of fuzzy sets and fuzzy logic.*

Computational Number Theory and Modern Cryptography

John Wiley & Sons *The only book to provide a unified view of the interplay between computational number theory and cryptography Computational number theory and modern cryptography are two of the most important and fundamental research fields in information security. In this book, Song Y. Yang combines knowledge of these two critical fields, providing a unified view of the relationships between computational number theory and cryptography. The author takes an innovative approach, presenting mathematical ideas first, thereupon treating cryptography as an immediate application of the mathematical concepts. The book also presents topics from number theory, which are relevant for applications in public-key cryptography, as well as modern topics, such as coding and lattice based cryptography for post-quantum cryptography. The author further covers the current research and applications for common cryptographic algorithms, describing the mathematical problems behind these applications in a manner accessible to computer scientists and engineers. Makes mathematical problems accessible to computer scientists and engineers by showing their immediate application Presents topics from number theory relevant for public-key cryptography applications Covers modern topics such as coding and lattice based cryptography for post-quantum cryptography Starts with the basics, then goes into applications and areas of active research Geared at a global audience; classroom tested in North America, Europe, and Asia Incudes exercises in every chapter Instructor resources available on the book's Companion Website Computational Number Theory and Modern Cryptography is ideal for graduate and advanced undergraduate students in computer science, communications engineering, cryptography and mathematics. Computer scientists, practicing cryptographers, and other professionals involved in various security schemes will also find this book to be a helpful reference.*

Cybercryptography: Applicable Cryptography for Cyberspace Security

Springer *This book provides the basic theory, techniques, and algorithms of modern cryptography that are applicable to network and cyberspace security. It consists of the following nine main chapters: Chapter 1 provides the basic concepts and ideas of cyberspace and cyberspace security, Chapters 2 and 3 provide an introduction to mathematical and computational preliminaries, respectively.*

Chapters 4 discusses the basic ideas and system of secret-key cryptography, whereas Chapters 5, 6, and 7 discuss the basic ideas and systems of public-key cryptography based on integer factorization, discrete logarithms, and elliptic curves, respectively. Quantum-safe cryptography is presented in Chapter 8 and offensive cryptography, particularly cryptovirology, is covered in Chapter 9. This book can be used as a secondary text for final-year undergraduate students and first-year postgraduate students for courses in Computer, Network, and Cyberspace Security. Researchers and practitioners working in cyberspace security and network security will also find this book useful as a reference.

Advances in Coding Theory and Cryptography

Introduction to Cryptography with Mathematical Foundations and Computer Implementations

CRC Press *From the exciting history of its development in ancient times to the present day, Introduction to Cryptography with Mathematical Foundations and Computer Implementations provides a focused tour of the central concepts of cryptography. Rather than present an encyclopedic treatment of topics in cryptography, it delineates cryptographic concepts in chronological order, developing the mathematics as needed. Written in an engaging yet rigorous style, each chapter introduces important concepts with clear definitions and theorems. Numerous examples explain key points while figures and tables help illustrate more difficult or subtle concepts. Each chapter is punctuated with "Exercises for the Reader;" complete solutions for these are included in an appendix. Carefully crafted exercise sets are also provided at the end of each chapter, and detailed solutions to most odd-numbered exercises can be found in a designated appendix. The computer implementation section at the end of every chapter guides students through the process of writing their own programs. A supporting website provides an extensive set of sample programs as well as downloadable platform-independent applet pages for some core programs and algorithms. As the reliance on cryptography by business, government, and industry continues and new technologies for transferring data become available, cryptography plays a permanent, important role in day-to-day operations. This self-contained sophomore-level text traces the evolution of the field, from its origins through present-day cryptosystems, including public key cryptography and elliptic curve cryptography.*

Cryptography and Coding

Fifth IMA Conference; Cirencester, UK, December 1995. Proceedings

Springer Science & Business Media *This monograph provides a formal and systematic exposition of the main results on the existence and optimality of equilibria in economies with increasing returns to scale. For that, a general equilibrium model is carefully constructed first by means of a precise formalization of consumers and firms, and the proof of an abstract existence result. The analysis shifts then to the study of specific normative and positive models which are particularizations the general one, and to the study of the efficiency of equilibrium allocations. The book provides an unified approach of the topic, it maintains a relatively low mathematical complexity and offers a highly self-contained exposition.*

Arithmetic, Geometry, Cryptography and Coding Theory

American Mathematical Soc. *This volume contains the proceedings of the 15th International Conference on Arithmetic, Geometry, Cryptography, and Coding Theory (AGCT), held at the Centre International de Rencontres Mathématiques in Marseille, France, from May 18–22, 2015. Since the first meeting almost 30 years ago, the biennial AGCT meetings have been one of the main events bringing together researchers interested in explicit aspects of arithmetic geometry and applications to coding theory and cryptography. This volume contains original research articles reflecting recent developments in the field.*

Cryptography and Coding

12th IMA International Conference, IMACC 2009, Cirencester, UK, December 15-17, 2009, Proceedings

Springer Science & Business Media *The12thintheseriesofIMAConferencesonCryptographyandCodingwasheld at the Royal Agricultural College, Cirencester, December 15–17, 2009. The p- gram comprised 3 invited talks and 26 contributed talks. The contributed talks werechosenbyathoroughreviewingprocessfrom53submissions.Oftheinvited and contributed talks,28 arerepresentedaspapersin this volume. These papers are grouped loosely under the headings: Coding Theory, Symmetric Crypt- raphy, Security Protocols, Asymmetric Cryptography, Boolean Functions, and Side Channels and Implementations. Numerous people helped to make this conference a success. To begin with I would like to thank all members of the Technical Program Committee who put a great deal of e?ort into the reviewing process so as to ensure a hi- quality program. Moreover, I wish to thank a number of people, external to the committee, who also contributed reviews on the submitted papers. Thanks, of course,mustalso goto*

allauthorswho submitted papers to the conference,both those rejected and accepted. The review process was also greatly facilitated by the use of the Web-submission-and-review software, written by Shai Halevi of IBM Research, and I would like to thank him for making this package available to the community. The invited talks were given by Frank Kschischang, Ronald Cramer, and Alexander Pott, and two of these invitedtalksappearaspapersinthisvolume. A particular thanks goes to these invited speakers, each of whom is well-known, notonlyforbeingaworld-leaderintheir?eld,butalsofortheirparticularability to communicate their expertise in an enjoyable and stimulating manner.

Cryptography and Coding

10th IMA International Conference, Cirencester, UK, December 19-21, 2005, Proceedings

Springer *This book constitutes the refereed proceedings of the 10th IMA International Conference on Cryptography and Coding, held in Cirencester, UK, in December 2005. The 26 revised full papers presented together with 4 invited contributions were carefully reviewed and selected from 94 submissions. The papers are organized in topical sections on coding theory, signatures and signcryption, symmetric cryptography, side channels, algebraic cryptanalysis, information theoretic applications, number theoretic foundations, and public key and ID-based encryption schemes.*

Quantum Computational Number Theory

Springer *This book provides a comprehensive introduction to advanced topics in the computational and algorithmic aspects of number theory, focusing on applications in cryptography. Readers will learn to develop fast algorithms, including quantum algorithms, to solve various classic and modern number theoretic problems. Key problems include prime number generation, primality testing, integer factorization, discrete logarithms, elliptic curve arithmetic, conjecture and numerical verification. The author discusses quantum algorithms for solving the Integer Factorization Problem (IFP), the Discrete Logarithm Problem (DLP), and the Elliptic Curve Discrete Logarithm Problem (ECDLP) and for attacking IFP, DLP and ECDLP based cryptographic systems. Chapters also cover various other quantum algorithms for Pell's equation, principal ideal, unit group, class group, Gauss sums, prime counting function, Riemann's hypothesis and the BSD conjecture. Quantum Computational Number Theory is self-contained and intended to be used either as a graduate text in computing, communications and mathematics, or as a basic reference in the related fields. Number theorists, cryptographers and professionals working in quantum computing, cryptography and network security will find this book a valuable asset.*

Cryptography and Coding

9th IMA International Conference, Cirencester, UK, December 16-18, 2003, Proceedings

Springer Science & Business Media *This book constitutes the refereed proceedings of the 9th IMA International Conference on Cryptography and Coding, held in Cirencester, UK in December 2003. The 25 revised full papers presented together with 4 invited contributions were carefully reviewed and selected from 49 submissions. The papers are organized in topical sections on coding and applications, applications of coding in cryptography, cryptography, cryptanalysis, network security and protocols.*

Coding Theory, Cryptography and Related Areas

Proceedings of an International Conference on Coding Theory, Cryptography and Related Areas, held in Guanajuato, Mexico, in April 1998

Springer Science & Business Media *A series of research papers on various aspects of coding theory, cryptography, and other areas, including new and unpublished results on the subjects. The book will be useful to students, researchers, professionals, and tutors interested in this area of research.*

Towards a Quarter-Century of Public Key Cryptography

A Special Issue of DESIGNS, CODES AND CRYPTOGRAPHY An International Journal. Volume 19, No. 2/3 (2000)

Springer Science & Business Media *Towards a Quarter-Century of Public Key Cryptography brings together in one place important contributions and up-to-date research results in this fast moving area. Towards a Quarter-Century of Public Key Cryptography serves as an excellent reference, providing insight into some of the most challenging research issues in the field.*

Applied Algebra, Algebraic Algorithms and Error-Correcting Codes

15th International Symposium, AAECC-15, Toulouse, France, May 12-16, 2003, Proceedings

Springer Science & Business Media *This book constitutes the refereed proceedings of the 15th International Symposium on Applied Algebra, Algebraic Algorithms and Error-Correcting Codes, AAECC-15, held in Toulouse, France, in May 2003. The 25 revised full papers presented together with 2 invited papers were carefully reviewed and selected from 40 submissions. Among the subjects addressed are block codes; algebra and codes: rings, fields, and AG codes; cryptography; sequences; decoding algorithms; and algebra: constructions in algebra, Galois groups, differential algebra, and polynomials.*

Topics in Geometry, Coding Theory and Cryptography

Springer Science & Business Media *The theory of algebraic function fields over finite fields has its origins in number theory. However, after Goppa`s discovery of algebraic geometry codes around 1980, many applications of function fields were found in different areas of mathematics and information theory. This book presents survey articles on some of these new developments. The topics focus on material which has not yet been presented in other books or survey articles.*

Cryptography and Coding

16th IMA International Conference, IMACC 2017, Oxford, UK, December 12-14, 2017, Proceedings

Springer *This book constitutes the proceedings of the 16th IMA International Conference on Cryptography and Coding, IMACC 2017, held at Oxford, UK, in December 2017. The 19 papers presented were carefully reviewed and selected from 32 submissions. The conference focuses on a diverse set of topics both in cryptography and coding theory.*

Primality Testing and Integer Factorization in Public-Key Cryptography

Springer Science & Business Media *Primality Testing and Integer Factorization in Public-Key Cryptography introduces various algorithms for primality testing and integer factorization, with their applications in public-key cryptography and information security. More specifically, this book explores basic concepts and results in number theory in Chapter 1. Chapter 2 discusses various algorithms for primality testing and prime number generation, with an emphasis on the Miller-Rabin probabilistic test, the Goldwasser-Kilian and Atkin-Morain elliptic curve tests, and the Agrawal-Kayal-Saxena deterministic test for primality. Chapter 3 introduces various algorithms, particularly the Elliptic Curve Method (ECM), the Quadratic Sieve (QS) and the Number Field Sieve (NFS) for integer factorization. This chapter also discusses some other computational problems that are related to factoring, such as the square root problem, the discrete logarithm problem and the quadratic residuosity problem.*

Quantum Attacks on Public-Key Cryptosystems

Springer Science & Business Media *The cryptosystems based on the Integer Factorization Problem (IFP), the Discrete Logarithm Problem (DLP) and the Elliptic Curve Discrete Logarithm Problem (ECDLP) are essentially the only three types of practical public-key cryptosystems in use. The security of these cryptosystems relies heavily on these three infeasible problems, as no polynomial-time algorithms exist for them so far. However, polynomial-time quantum algorithms for IFP, DLP and ECDLP do exist, provided that a practical quantum computer exists. Quantum Attacks on Public-Key Cryptosystems presemts almost all known quantum computing based attacks on public-key cryptosystems, with an emphasis on quantum algorithms for IFP, DLP, and ECDLP. It also discusses some quantum resistant cryptosystems to replace the IFP, DLP and ECDLP based cryptosystems. This book is intended to be used either as a graduate text in computing, communications and mathematics, or as a basic reference in the field.*

Coding Theory and Cryptography

The Essentials, Second Edition

CRC Press *Containing data on number theory, encryption schemes, and cyclic codes, this highly successful textbook, proven by the authors in a popular two-quarter course, presents coding theory, construction, encoding, and decoding of specific code families in an "easy-to-use" manner appropriate for students with only a basic background in mathematics offering revised and updated material on the Berlekamp-Massey decoding algorithm and convolutional codes. Introducing the mathematics as it is needed and providing exercises with solutions, this edition includes an extensive section on cryptography, designed for an introductory course on the subject.*

Code-Based Cryptography

7th International Workshop, CBC 2019, Darmstadt, Germany, May 18–19, 2019, Revised Selected Papers

Springer *This book constitutes the refereed and revised post-conference proceedings of the 7th International Workshop on Code-Based Cryptography, CBC 2019, held in Darmstadt, Germany, in May 2019. The eight papers presented in this book were carefully reviewed and selected from numerous submissions. These contributions are divided into two groups: The first four papers deal with the design of code-based cryptosystems, while the following four papers are on cryptanalysis of code-based cryptosystems.*

Mathematics of Public Key Cryptography

Cambridge University Press *This advanced graduate textbook gives an authoritative and insightful description of the major ideas and techniques of public key cryptography.*

Algebraic Aspects of Cryptography

Springer Science & Business Media *From the reviews: "This is a textbook in cryptography with emphasis on algebraic methods. It is supported by many exercises (with answers) making it appropriate for a course in mathematics or computer science. [...] Overall, this is an excellent expository text, and will be very useful to both the student and researcher." Mathematical Reviews*

Algorithmic Strategies for Solving Complex Problems in Cryptography

IGI Global *Cryptography is a field that is constantly advancing, due to exponential growth in new technologies within the past few decades. Applying strategic algorithms to cryptic issues can help save time and energy in solving the expanding problems within this field. Algorithmic Strategies for Solving Complex Problems in Cryptography is an essential reference source that discusses the evolution and current trends in cryptology, and it offers new insight into how to use strategic algorithms to aid in solving intricate difficulties within this domain. Featuring relevant topics such as hash functions, homomorphic encryption schemes, two party computation, and integer factoring, this publication is ideal for academicians, graduate students, engineers, professionals, and researchers interested in expanding their knowledge of current trends and techniques within the cryptology field.*

Gröbner Bases, Coding, and Cryptography

Springer Science & Business Media *Coding theory and cryptography allow secure and reliable data transmission, which is at the heart of modern communication. Nowadays, it is hard to find an electronic device without some code inside. Gröbner bases have emerged as the main tool in computational algebra, permitting numerous applications, both in theoretical contexts and in practical situations. This book is the first book ever giving a comprehensive overview on the application of commutative algebra to coding theory and cryptography. For example, all important properties of algebraic/geometric coding systems (including encoding, construction, decoding, list decoding) are individually analysed, reporting all significant approaches appeared in the literature. Also, stream ciphers, PK cryptography, symmetric cryptography and Polly Cracker systems deserve each a separate chapter, where all the relevant literature is reported and compared. While many short notes hint at new exciting directions, the reader will find that all chapters fit nicely within a unified notation.*

Number-Theoretic Algorithms in Cryptography

American Mathematical Soc. *Algorithmic number theory is a rapidly developing branch of number theory, which, in addition to its mathematical importance, has substantial applications in computer science and cryptography. Among the algorithms used in cryptography, the following are especially important: algorithms for primality testing; factorization algorithms for integers and for polynomials in one variable; applications of the theory of elliptic curves; algorithms for computation of discrete logarithms; algorithms*

for solving linear equations over finite fields; and, algorithms for performing arithmetic operations on large integers. The book describes the current state of these and some other algorithms. It also contains extensive bibliography. For this English translation, additional references were prepared and commented on by the author.

Cryptology and Error Correction

An Algebraic Introduction and Real-World Applications

Springer *This text presents a careful introduction to methods of cryptology and error correction in wide use throughout the world and the concepts of abstract algebra and number theory that are essential for understanding these methods. The objective is to provide a thorough understanding of RSA, Diffie–Hellman, and Blum–Goldwasser cryptosystems and Hamming and Reed–Solomon error correction: how they are constructed, how they are made to work efficiently, and also how they can be attacked. To reach that level of understanding requires and motivates many ideas found in a first course in abstract algebra—rings, fields, finite abelian groups, basic theory of numbers, computational number theory, homomorphisms, ideals, and cosets. Those who complete this book will have gained a solid mathematical foundation for more specialized applied courses on cryptology or error correction, and should also be well prepared, both in concepts and in motivation, to pursue more advanced study in algebra and number theory. This text is suitable for classroom or online use or for independent study. Aimed at students in mathematics, computer science, and engineering, the prerequisite includes one or two years of a standard calculus sequence. Ideally the reader will also take a concurrent course in linear algebra or elementary matrix theory. A solutions manual for the 400 exercises in the book is available to instructors who adopt the text for their course.*

Coding, Cryptography and Combinatorics

Birkhäuser *It has long been recognized that there are fascinating connections between cod ing theory, cryptology, and combinatorics. Therefore it seemed desirable to us to organize a conference that brings together experts from these three areas for a fruitful exchange of ideas. We decided on a venue in the Huang Shan (Yellow Mountain) region, one of the most scenic areas of China, so as to provide the additional inducement of an attractive location. The conference was planned for June 2003 with the official title Workshop on Coding, Cryptography and Combi natorics (CCC 2003). Those who are familiar with events in East Asia in the first half of 2003 can guess what happened in the end, namely the conference had to be cancelled in the interest of the health of the participants. The SARS epidemic posed too serious a threat. At the time of the cancellation, the organization of the conference was at an advanced stage: all invited speakers had been selected and all abstracts of contributed talks had been screened by the program committee. Thus, it was de cided to call on all invited speakers and presenters of accepted contributed talks to submit their manuscripts for publication in the present volume. Altogether, 39 submissions were received and subjected to another round of refereeing. After care ful scrutiny, 28 papers were accepted for publication.*

Algebraic Geometry in Coding Theory and Cryptography

Princeton University Press *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*

Post-Quantum Cryptography

5th International Workshop, PQCrypto 2013, Limoges, France, June 4-7, 2013, Proceedings

Springer *This book constitutes the refereed proceedings of the 5th International Workshop on Post-Quantum Cryptography, PQCrypto 2013, held in Limoges, France, in June 2013. The 17 revised full papers presented were carefully reviewed and selected from 24 submissions. The papers cover all technical aspects of cryptographic research related to the future world with large quantum computers such as code-based cryptography, lattice-based cryptography, multivariate cryptography, cryptanalysis or implementations.*

Encyclopedia of Cryptography and Security

Springer Science & Business Media *Expanded into two volumes, the Second Edition of Springer's Encyclopedia of Cryptography and Security brings the latest and most comprehensive coverage of the topic: Definitive information on cryptography and information security from highly regarded researchers Effective tool for professionals in many fields and researchers of all levels Extensive resource with more than 700 contributions in Second Edition 5643 references, more than twice the number of references that appear in the First Edition With over 300 new entries, appearing in an A-Z format, the Encyclopedia of Cryptography and Security provides easy, intuitive access to information on all aspects of cryptography and security. As a critical enhancement to the First Edition's base of 464 entries, the information in the Encyclopedia is relevant for researchers and professionals alike. Topics for this comprehensive reference were elected, written, and peer-reviewed by a pool of distinguished researchers in the field. The Second Edition's editorial board now includes 34 scholars, which was expanded from 18 members in the First Edition. Representing the work of researchers from over 30 countries, the Encyclopedia is broad in scope, covering everything from authentication and identification to quantum cryptography and web security. The text's practical style is instructional, yet fosters investigation. Each area presents concepts, designs, and specific implementations. The highly-structured essays in this work include synonyms, a definition and discussion of the topic, bibliographies, and links to related literature. Extensive cross-references to other entries within the Encyclopedia support efficient, user-friendly searches for immediate access to relevant information. Key concepts presented in the Encyclopedia of Cryptography and Security include: Authentication and identification; Block ciphers and stream ciphers; Computational issues; Copy protection; Cryptanalysis and security; Cryptographic protocols; Electronic payment and digital certificates; Elliptic curve cryptography; Factorization algorithms and primality tests; Hash functions and MACs; Historical systems; Identity-based cryptography; Implementation aspects for smart cards and standards; Key management; Multiparty computations like voting schemes; Public key cryptography; Quantum cryptography; Secret sharing schemes; Sequences; Web Security. Topics covered: Data Structures, Cryptography and Information Theory; Data Encryption; Coding and Information Theory; Appl.Mathematics/Computational Methods of Engineering; Applications of Mathematics; Complexity. This authoritative reference will be published in two formats: print and online. The online edition features hyperlinks to cross-references, in addition to significant research.*

Introduction to Cryptography

Principles and Applications

Springer *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.*

Tutorials on the Foundations of Cryptography

Dedicated to Oded Goldreich

Springer *This is a graduate textbook of advanced tutorials on the theory of cryptography and computational complexity. In particular, the chapters explain aspects of garbled circuits, public-key cryptography, pseudorandom functions, one-way functions, homomorphic encryption, the simulation proof technique, and the complexity of differential privacy. Most chapters progress methodically through motivations, foundations, definitions, major results, issues surrounding feasibility, surveys of recent developments, and suggestions for further study. This book honors Professor Oded Goldreich, a pioneering scientist, educator, and mentor. Oded was instrumental in laying down the foundations of cryptography, and he inspired the contributing authors, Benny Applebaum, Boaz Barak, Andrej Bogdanov, Iftach Haitner, Shai Halevi, Yehuda Lindell, Alon Rosen, and Salil Vadhan, themselves leading researchers on the theory of cryptography and computational complexity. The book is appropriate for graduate tutorials and seminars, and for self-study by experienced researchers, assuming prior knowledge of the theory of cryptography.*

A Course in Cryptography

American Mathematical Soc. *This book provides a compact course in modern cryptography. The mathematical foundations in algebra, number theory and probability are presented with a focus on their cryptographic applications. The text provides rigorous definitions and follows the provable security approach. The most relevant cryptographic schemes are covered, including block ciphers, stream ciphers, hash functions, message authentication codes, public-key encryption, key establishment, digital signatures and elliptic*

curves. The current developments in post-quantum cryptography are also explored, with separate chapters on quantum computing, lattice-based and code-based cryptosystems. Many examples, figures and exercises, as well as SageMath (Python) computer code, help the reader to understand the concepts and applications of modern cryptography. A special focus is on algebraic structures, which are used in many cryptographic constructions and also in post-quantum systems. The essential mathematics and the modern approach to cryptography and security prepare the reader for more advanced studies. The text requires only a first-year course in mathematics (calculus and linear algebra) and is also accessible to computer scientists and engineers. This book is suitable as a textbook for undergraduate and graduate courses in cryptography as well as for self-study.

Code-Based Cryptography

9th International Workshop, CBCrypto 2021, Munich, Germany, June 21–22, 2021 Revised Selected Papers

Springer Nature

Advances in Cryptology – EUROCRYPT 2018

37th Annual International Conference on the Theory and Applications of Cryptographic Techniques, Tel Aviv, Israel, April 29 - May 3, 2018 Proceedings, Part II

Springer *The three volumes LNCS 10820, 10821, and 10822 constitute the thoroughly refereed proceedings of the 37th Annual International Conference on the Theory and Applications of Cryptographic Techniques, EUROCRYPT 2018, held in Tel Aviv, Israel, in April/May 2018. The 69 full papers presented were carefully reviewed and selected from 294 submissions. The papers are organized into the following topical sections: foundations; lattices; random oracle model; fully homomorphic encryption; permutations; galois counter mode; attribute-based encryption; secret sharing; blockchain; multi-collision resistance; signatures; private simultaneous messages; masking; theoretical multiparty computation; obfuscation; symmetric cryptanalysis; zero-knowledge; implementing multiparty computation; non-interactive zero-knowledge; anonymous communication; isogeny; leakage; key exchange; quantum; non-malleable codes; and provable symmetric cyptography.*

History of Cryptography and Cryptanalysis

Codes, Ciphers, and Their Algorithms

Springer *This accessible textbook presents a fascinating review of cryptography and cryptanalysis across history. The text relates the earliest use of the monoalphabetic cipher in the ancient world, the development of the "unbreakable" Vigenère cipher, and an account of how cryptology entered the arsenal of military intelligence during the American Revolutionary War. Moving on to the American Civil War, the book explains how the Union solved the Vigenère ciphers used by the Confederates, before investigating the development of cipher machines throughout World War I and II. This is then followed by an exploration of cryptology in the computer age, from public-key cryptography and web security, to criminal cyber-attacks and cyber-warfare. Looking to the future, the role of cryptography in the Internet of Things is also discussed, along with the potential impact of quantum computing. Topics and features: presents a history of cryptology from ancient Rome to the present day, with a focus on cryptology in the 20th and 21st centuries; reviews the different types of cryptographic algorithms used to create secret messages, and the various methods for breaking such secret messages; provides engaging examples throughout the book illustrating the use of cryptographic algorithms in different historical periods; describes the notable contributions to cryptology of Herbert Yardley, William and Elizebeth Smith Friedman, Lester Hill, Agnes Meyer Driscoll, and Claude Shannon; concludes with a review of tantalizing unsolved mysteries in cryptology, such as the Voynich Manuscript, the Beale Ciphers, and the Kryptos sculpture. This engaging work is ideal as both a primary text for courses on the history of cryptology, and as a supplementary text for advanced undergraduate courses on computer security. No prior background in mathematics is assumed, beyond what would be encountered in an introductory course on discrete mathematics.*

Number Theory and Cryptography

Cambridge University Press *Papers presented by prominent contributors at a workshop on Number Theory and Cryptography, and the annual meeting of the Australian Mathematical Society.*

Chinese Remainder Theorem

Applications in Computing, Coding, Cryptography

World Scientific *Chinese Remainder Theorem, CRT, is one of the jewels of mathematics. It is a perfect combination of beauty and utility or, in the words of Horace, omne tulit punctum qui miscuit utile dulci. Known already for ages, CRT continues to present itself in new contexts and open vistas for new types of applications. So far, its usefulness has been obvious within the realm of "three C's". Computing was its original field of application, and continues to be important as regards various aspects of algorithmics and modular computations. Theory of codes and cryptography are two more recent fields of application. This book tells about CRT, its background and philosophy, history, generalizations and, most importantly, its applications. The book is self-contained. This means that no factual knowledge is assumed on the part of the reader. We even provide brief tutorials on relevant subjects, algebra and information theory. However, some mathematical maturity is surely a prerequisite, as our presentation is at an advanced undergraduate or beginning graduate level. We have tried to make the exposition innovative, many of the individual results being new. We will return to this matter, as well as to the interdependence of the various parts of the book, at the end of the Introduction. A special course about CRT can be based on the book. The individual chapters are largely independent and, consequently, the book can be used as supplementary material for courses in algorithmics, coding theory, cryptography or theory of computing. Of course, the book is also a reference for matters dealing with CRT. Contents:Introduction and PhilosophyChinese Remainder AlgorithmIn Modular ComputationsIn AlgorithmicsIn Bridging ComputationsIn Coding TheoryIn CryptographyTutorial in Information TheoryTutorial in AlgebraList of Mathematical SymbolsBibliography Readership: Postgraduate students, researchers and scientists of theoretical foundations of computer science, numerical and computational methods. keywords: "It is a good book about the basic principles of trellis decoding for block codes, existing open problems, some recent solutions, and different applications of this technique." Computing Reviews*

Discrete Mathematics

Graph Algorithms, Algebraic Structures, Coding Theory, and Cryptography

CRC Press *Conveying ideas in a user-friendly style, this book has been designed for a course in Applied Algebra. The book covers graph algorithms, basic algebraic structures, coding theory and cryptography. It will be most suited for senior undergraduates and beginning graduate students in mathematics and computer science as also to individuals who want to have a knowledge of the below-mentioned topics. Provides a complete discussion on several graph algorithms such as Prims algorithm and Kruskals algorithm for sending a minimum cost spanning tree in a weighted graph, Dijkstras single source shortest path algorithm, Floyds algorithm, Warshalls algorithm, Kuhn-Munkres Algorithm. In addition to DFS and BFS search, several applications of DFS and BFS are also discussed. Presents a good introduction to the basic algebraic structures, namely, matrices, groups, rings, fields including finite fields as also a discussion on vector spaces and linear equations and their solutions. Provides an introduction to linear codes including cyclic codes. Presents a description of private key cryptosystems as also a discussion on public key cryptosystems such as RSA, ElGamal and Miller-Rabin. Finally, the Agrawal-KayalSaxena algorithm (AKS Algorithm) for testing if a given positive integer is prime or not in polynomial time is presented- the first time in a textbook. Two distinguished features of the book are: Illustrative examples have been presented throughout the book to make the readers appreciate the concepts described. Answers to all even-numbered exercises in all the chapters are given.*

Boolean Functions in Coding Theory and Cryptography

American Mathematical Soc. *This book offers a systematic presentation of cryptographic and code-theoretic aspects of the theory of Boolean functions. Both classical and recent results are thoroughly presented. Prerequisites for the book include basic knowledge of linear algebra, group theory, theory of finite fields, combinatorics, and probability. The book can be used by research mathematicians and graduate students interested in discrete mathematics, coding theory, and cryptography.*