

A Course in

Computational Number Theory



David Bressoud

Stan Wagon

Course In Computational Number Theory

Song Y. Yan



Course In Computational Number Theory:

A Course in Computational Algebraic Number Theory Henri Cohen, 1993 Describes 148 algorithms that are fundamental for number theoretic computations including computations related to algebraic number theory elliptic curves primality testing and factoring A complete theoretical introduction is given for each subject reducing prerequisites to a minimum The detailed description of each algorithm allows immediate *A Course in Computational Algebraic Number Theory* Henri Cohen, 2013-04-17 With the advent of powerful computing tools and numerous advances in mathematics computer science and cryptography algorithmic number theory has become an important subject in its own right Both external and internal pressures gave a powerful impetus to the development of more powerful algorithms These in turn led to a large number of spectacular breakthroughs To mention but a few the LLL algorithm which has a wide range of applications including real world applications to integer programming primality testing and factoring algorithms sub exponential class group and regulator algorithms etc Several books exist which treat parts of this subject It is essentially impossible for an author to keep up with the rapid pace of progress in all areas of this subject Each book emphasizes a different area corresponding to the author's tastes and interests The most famous but unfortunately the oldest is Knuth's Art of Computer Programming especially Chapter 4 The present book has two goals First to give a reasonably comprehensive introductory course in computational number theory In particular although we study some subjects in great detail others are only mentioned but with suitable pointers to the literature Hence we hope that this book can serve as a first course on the subject A natural sequel would be to study more specialized subjects in the existing literature *A Course in Computational Number Theory* David Bressoud, S. Wagon, 2000-05-11 The accompanying CD Rom contains Mathematica files with all the commands and programs P 4 of cover *Advanced Topics in Computational Number Theory* Henri Cohen, 2012-10-29 The computation of invariants of algebraic number fields such as integral bases discriminants prime decompositions ideal class groups and unit groups is important both for its own sake and for its numerous applications for example to the solution of Diophantine equations The practical completion of this task sometimes known as the Dedekind program has been one of the major achievements of computational number theory in the past ten years thanks to the efforts of many people Even though some practical problems still exist one can consider the subject as solved in a satisfactory manner and it is now routine to ask a specialized Computer Algebra System such as Kant Kash liDIA Magma or Pari GP to perform number field computations that would have been unfeasible only ten years ago The very numerous algorithms used are essentially all described in *A Course in Computational Algebraic Number Theory* GTM 138 first published in 1993 third corrected printing 1996 which is referred to here as CohO That text also treats other subjects such as elliptic curves factoring and primality testing It is important and natural to generalize these algorithms Several generalizations can be considered but the most important are certainly the generalizations to global function fields finite extensions of the field of rational functions in one variable over a

finite field and to relative extensions of number fields As in CohO in the present book we will consider number fields only and not deal at all with function fields

Computational Number Theory and Modern Cryptography Song Y. Yan, 2013-01-29 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 Includes 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

Public-Key Cryptography and Computational Number Theory Kazimierz Alster, Jerzy

Urbanowicz, Hugh C. Williams, 2011-06-24 The Proceedings contain twenty selected refereed contributions arising from the International Conference on Public Key Cryptography and Computational Number Theory held in Warsaw Poland on September 11 15 2000 The conference attended by eightyfive mathematicians from eleven countries was organized by the Stefan Banach International Mathematical Center This volume contains articles from leading experts in the world on cryptography and computational number theory providing an account of the state of research in a wide variety of topics related to the conference theme It is dedicated to the memory of the Polish mathematicians Marian Rejewski 1905 1980 Jerzy R ycki 1909 1942 and Henryk Zygalski 1907 1978 who deciphered the military version of the famous Enigma in December 1932 January 1933 A noteworthy feature of the volume is a foreword written by Andrew Odlyzko on the progress in cryptography from Enigma time until now

COURSE IN COMPUTATIONAL ALGEBRAIC NUMBER THEORY , 1993

Computational Number Theory Abhijit Das, 2016-04-19 Developed from the author's popular graduate level course Computational Number Theory presents a complete treatment of number theoretic algorithms Avoiding advanced algebra

this self contained text is designed for advanced undergraduate and beginning graduate students in engineering It is also suitable for researchers new to the field and pract

Cryptography and Computational Number Theory Kwok Y. Lam,Igor Shparlinski,Huaxiong Wang,Chaoping Xing,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 National University of Singapore We gratefully acknowledge the financial support from the Singapore National Science and Technology Board under the grant number 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 theory 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

Quantum Computational Number Theory Song Y. Yan,2015-12-26 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

Computational Excursions in Analysis and Number Theory Peter Borwein,2002-07-12 This introduction to computational number theory is centered on a number of problems that live at the interface of analytic computational and Diophantine number theory and provides a diverse collection of techniques for solving number theoretic problems There are many exercises and open research problems included

Arithmetic Geometry, Number Theory, and Computation Jennifer S. Balakrishnan,Noam Elkies,Brendan Hassett,Bjorn Poonen,Andrew V. Sutherland,John Voight,2022-03-15 This

volume contains articles related to the work of the Simons Collaboration Arithmetic Geometry Number Theory and Computation The papers present mathematical results and algorithms necessary for the development of large scale databases like the L functions and Modular Forms Database LMFDB The authors aim to develop systematic tools for analyzing Diophantine properties of curves surfaces and abelian varieties over number fields and finite fields The articles also explore examples important for future research Specific topics include algebraic varieties over finite fields the Chabauty Coleman method modular forms rational points on curves of small genus S unit equations and integral points

A Course in Computational Number Theory David Bressoud, S. Wagon, 2000-05-11 The accompanying CD Rom contains Mathematica files with all the commands and programs P 4 of cover

Computational Group Theory and the Theory of Groups Luise-Charlotte Kappe, Arturo Magidin, Robert Fitzgerald Morse, 2008 The power of general purpose computational algebra systems running on personal computers has increased rapidly in recent years For mathematicians doing research in group theory this means a growing set of sophisticated computational tools are now available for their use in developing new theoretical results This volume consists of contributions by researchers invited to the AMS Special Session on Computational Group Theory held in March 2007 The main focus of the session was on the application of Computational Group Theory CGT to a wide range of theoretical aspects of group theory The articles in this volume provide a variety of examples of how these computer systems helped to solve interesting theoretical problems within the discipline such as constructions of finite simple groups classification of p groups via coclass representation theory and constructions involving free nilpotent groups The volume also includes an article by R F Morse highlighting applications of CGT in group theory and two survey articles Graduate students and researchers interested in various aspects of group theory will find many examples of Computational Group Theory helping research and will recognize it as yet another tool at their disposal

BOOK JACKET Handbook of Computational Group Theory Derek F. Holt, Bettina Eick, Eamonn A. O'Brien, 2005-01-13 The origins of computation group theory CGT date back to the late 19th and early 20th centuries Since then the field has flourished particularly during the past 30 to 40 years and today it remains a lively and active branch of mathematics The Handbook of Computational Group Theory offers the first complete treatment of all the fundame

Introduction to Modern Number Theory Yu. I. Manin, Alexei A. Panchishkin, 2006-03-30 This edition has been called startlingly up to date and in this corrected second printing you can be sure that it s even more contemporaneous It surveys from a unified point of view both the modern state and the trends of continuing development in various branches of number theory Illuminated by elementary problems the central ideas of modern theories are laid bare Some topics covered include non Abelian generalizations of class field theory recursive computability and Diophantine equations zeta and L functions This substantially revised and expanded new edition contains several new sections such as Wiles proof of Fermat s Last Theorem and relevant techniques coming from a synthesis of various theories

Notes from the International Autumn School on Computational Number Theory Ilker Inam, Engin

Büyükaşık,2019-04-17 This volume collects lecture notes and research articles from the International Autumn School on Computational Number Theory which was held at the Izmir Institute of Technology from October 30th to November 3rd 2017 in Izmir Turkey Written by experts in computational number theory the chapters cover a variety of the most important aspects of the field By including timely research and survey articles the text also helps pave a path to future advancements Topics include Modular forms L functions The modular symbols algorithm Diophantine equations Nullstellensatz Eisenstein series Notes from the International Autumn School on Computational Number Theory will offer graduate students an invaluable introduction to computational number theory In addition it provides the state of the art of the field and will thus be of interest to researchers interested in the field aswell *Using the Mathematics Literature* Kristine K.

Fowler,2004-05-25 This reference serves as a reader friendly guide to every basic tool and skill required in the mathematical library and helps mathematicians find resources in any format in the mathematics literature It lists a wide range of standard texts journals review articles newsgroups and Internet and database tools for every major subfield in mathematics and details methods of access to primary literature sources of new research applications results and techniques Using the Mathematics Literature is the most comprehensive and up to date resource on mathematics literature in both print and electronic formats presenting time saving strategies for retrieval of the latest information The Symmetric Group Bruce E.

Sagan,2013-03-09 I have been very gratified by the response to the first edition which has resulted in it being sold out This put some pressure on me to come out with a second edition and now finally here it is The original text has stayed much the same the major change being in the treatment of the hook formula which is now based on the beautiful Novelli Pak Stoyanovskii bijection NPS 97 I have also added a chapter on applications of the material from the first edition This includes Stanley s theory of differential posets Stn 88 Stn 90 and Fomin s related concept of growths Fom 86 Fom 94 Fom 95 which extends some of the combinatorics of S_n representations Next come a couple of sections showing how groups acting on posets give rise to interesting representations that can be used to prove unimodality results Stn 82 Finally we discuss Stanley s symmetric function analogue of the chromatic polynomial of a graph Stn 95 Stn ta I would like to thank all the people too numerous to mention who pointed out typos in the first edition My computer has been severely reprimanded for making them Thanks also go to Christian Krattenthaler Tom Roby and Richard Stanley all of whom read portions of the new material and gave me their comments Finally I would like to give my heartfelt thanks to my editor at Springer Ina Lindemann who has been very supportive and helpful through various difficult times **Cryptology and Computational Number Theory** Carl

Pomerance,Shafi Goldwasser,1990 In the past dozen or so years cryptology and computational number theory have become increasingly intertwined Because the primary cryptologic application of number theory is the apparent intractability of certain computations these two fields could part in the future and again go their separate ways But for now their union is continuing to bring ferment and rapid change in both subjects This book contains the proceedings of an AMS Short Course in

Cryptology and Computational Number Theory held in August 1989 during the Joint Mathematics Meetings in Boulder Colorado These eight papers by six of the top experts in the field will provide readers with a thorough introduction to some of the principal advances in cryptology and computational number theory over the past fifteen years In addition to an extensive introductory article the book contains articles on primality testing discrete logarithms integer factoring knapsack cryptosystems pseudorandom number generators the theoretical underpinnings of cryptology and other number theory based cryptosystems Requiring only background in elementary number theory this book is aimed at nonexperts including graduate students and advanced undergraduates in mathematics and computer science

This book delves into Course In Computational Number Theory. Course In Computational Number Theory is a vital topic that must be grasped by everyone, ranging from students and scholars to the general public. This book will furnish comprehensive and in-depth insights into Course In Computational Number Theory, encompassing both the fundamentals and more intricate discussions.

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- The book is crafted in an easy-to-understand language and is complemented by engaging illustrations. It is highly recommended for anyone seeking to gain a comprehensive understanding of Course In Computational Number Theory.

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