

# Some Interesting Applications Of Number Theory

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**Abstract:** This chapter aims to introduce the reader to applications of Number theory in various disciplines including Cryptography, Statics and Chemistry that is the idea of encryption technique using RSA public key cryptography for finding the enciphering exponent and recovery element, balancing chemical equations using linear Diophantine equation with the help of matrices and Ladder problems in statics using Pythagorean triangles involving Jarasandha numbers.

**Keywords:** Cryptography, Encryption, RSA public Key, Balancing Chemical Equations, Jarasandha numbers, Statics, Ladder, Diophantine Equations, Pythagorean Triples.

## 1. INTRODUCTION:

Number theory is fascinating on the grounds that it has such a large number of open problems that seem accessible from the outside. Of course, open problems in number theory are open for a reason. Numbers, despite being simple, have an incredibly rich structure which we only understand to a limited degree. Number theory and its different subfields will keep on enthraling the brains of mathematicians for a very long time [1-5]. Apart from the polygonal numbers we have some more fascinating patterns of numbers namely Jarasandha numbers, Nasty numbers and Dhuruva numbers.

In our Indian epic Mahabharata, we come across a demoniac figure named 'JARASANDHA'. He had a boon that if he was split into two parts and thrown apart, the parts would rejoin and return to life. In fact, he was given life by the two halves of his body. In the field of Mathematics, we have numbers exhibiting the same property as Jarasandha. Consider a number of the form  $XC$ . This may split as two numbers  $X$  and  $C$ , if these numbers are added and squared we get the same number  $XC$ .

(i.e)  $XC = (X + C)^2$

Also, if  $C$  is an  $n$ -digit number, then  $(X + C)^2 = (10^n)(X) + C$

# Number Theory And Applications

**Jordi Guàrdia, Nicușor Minculete, Diana  
Savin, Montserrat Vela, Abdelkader  
Zekhnini**

## Number Theory And Applications:

**Advanced Number Theory with Applications** Richard A. Mollin, 2009-08-26 Exploring one of the most dynamic areas of mathematics Advanced Number Theory with Applications covers a wide range of algebraic analytic combinatorial cryptographic and geometric aspects of number theory Written by a recognized leader in algebra and number theory the book includes a page reference for every citing in the bibliography and mo Fundamental Number Theory with Applications Richard A. Mollin, 2008-02-21 An update of the most accessible introductory number theory text available Fundamental Number Theory with Applications Second Edition presents a mathematically rigorous yet easy to follow treatment of the fundamentals and applications of the subject The substantial amount of reorganizing makes this edition clearer and more elementary in i *Number Theory With Applications* Wen-ching Li, 1996-02-16 Novel and important applications of number theory to graph theory and vice versa had been made in the past decade The two main tools used are based on the estimates of character sums and the estimates of the eigenvalues of Hecke operators both are rooted in the celebrated Weil conjectures settled by Deligne in 1973 The purpose of this book is to give from scratch a coherent and comprehensive introduction to the topics in number theory related to the central tools with the ultimate goal of presenting their applications This book includes many important subjects in number theory such as Weil conjectures Riemann Roch theorem L functions character sum estimates modular forms and representation theory Elementary Number Theory with Applications Thomas Koshy, 2002 Elementary Number Theory focuses on number theory s role in the rapid development of art coding theory cryptology computer science and other necessities of modern life confirming that human ingenuity and creativity are boundless **Elementary Number Theory and Its Applications** Kenneth H. Rosen, 1993 New edition of a standard text Integrates classical material with applications to cryptography and computer science The author is with AT T Bell Labs Annotation copyright Book News Inc Portland Or **Number Theory and Applications** S.D. Adhikari, B. Ramakrishnan, 2009-06-15 This collection of articles contains the proceedings of the two international conferences on Number Theory and Cryptography held at the Harish Chandra Research Institute In recent years the interest in number theory has increased due to its applications in areas like error correcting codes and cryptography These proceedings contain papers in various areas of number theory such as combinatorial algebraic analytic and transcendental aspects arithmetic algebraic geometry as well as graph theory and cryptography While some papers do contain new results several of the papers are expository articles that mention open questions which will be useful to young researchers *Applications of Number Theory to Numerical Analysis* L.-K. Hua, Y. Wang, 2012-12-06 Owing to the developments and applications of computer science ma thematicians began to take a serious interest in the applications of number theory to numerical analysis about twenty years ago The progress achieved has been both important practically as well as satisfactory from the theoretical view point It or example from the seventeenth century till now a great deal of effort was made in developing

methods for approximating single integrals and there were only a few works on multiple quadrature until the 1950 s But in the past twenty years a number of new methods have been devised of which the number theoretic method is an effective one The number theoretic method may be described as follows We use number theory to construct a sequence of uniformly distributed sets in the  $s$  dimensional unit cube  $G$  where  $s \geq 2$  Then we use the sequence to approximate the definite integral over  $G$  such that the principal order of the error term is shown to be of the best possible kind if the integrand satisfies certain conditions *New Frontiers in Number Theory and Applications* Jordi Guàrdia, Nicușor Minculete, Diana Savin, Montserrat Vela, Abdelkader Zekhnini, 2024-05-27

This contributed volume presents recent advances as well as new directions in number theory and its applications Algebraic and analytic number theory are the main focus with chapters showing how these areas are rapidly evolving By gathering authors from over seven countries readers will gain an international perspective on the current state of research as well as potential avenues to explore Specific topics covered include Algebraic Number Theory Elliptic curves and Cryptography Hopf Galois theory Analytic and elementary number theory and applications *New Frontiers in Number Theory and Applications* will appeal to researchers interested in gaining a global view of current research in number theory

**Number Theory** James Pommersheim, Tim Marks, Erica Flapan, 2010-02-15 *Number Theory A Lively Introduction with Proofs Applications and Stories* is a new book that provides a rigorous yet accessible introduction to elementary number theory along with relevant applications Readable discussions motivate new concepts and theorems before their formal definitions and statements are presented Many theorems are preceded by Numerical Proof Previews which are numerical examples that will help give students a concrete understanding of both the statements of the theorems and the ideas behind their proofs before the statement and proof are formalized in more abstract terms In addition many applications of number theory are explained in detail throughout the text including some that have rarely if ever appeared in textbooks A unique feature of the book is that every chapter includes a math myth a fictional story that introduces an important number theory topic in a friendly inviting manner Many of the exercise sets include in depth Explorations in which a series of exercises develop a topic that is related to the material in the section

**Number Theory And Its Applications II** Hailong Li, Fuhuo Li, Nianliang Wang, Shigeru Kanemitsu, 2017-11-29 The aim of the book is to give a smooth analytic continuation from basic subjects including linear algebra group theory Hilbert space theory etc to number theory With plenty of practical examples and worked out exercises and the scope ranging from these basic subjects made applicable to number theoretic settings to advanced number theory this book can then be read without tears It will be of immense help to the reader to acquire basic sound skills in number theory and its applications Number theory used to be described as the queen of mathematics that is there is no practical use However with the development of computers and the security of internet communications the

importance of number theory has been exponentially increasing daily The raison d'être of the present book in this situation is that it is extremely reader friendly while keeping the rigor of serious mathematics and in depth analysis of practical applications to various subjects including control theory and pseudo random number generation The use of operators is prevailing rather abundantly in anticipation of applications to electrical engineering allowing the reader to master these skills without much difficulty It also delivers a very smooth bridging between elementary subjects including linear algebra and group theory and algebraic number theory for the reader to be well versed in an efficient and effortless way One of the main features of the book is that it gives several different approaches to the same topic helping the reader to gain deeper insight and comprehension Even just browsing through the materials would be beneficial to the reader

Emerging Applications of Number Theory Dennis A. Hejhal, 1999-05-21 Most people tend to view number theory as the very paradigm of pure mathematics With the advent of computers however number theory has been finding an increasing number of applications in practical settings such as in cryptography random number generation coding theory and even concert hall acoustics Yet other applications are still emerging providing number theorists with some major new areas of opportunity The 1996 IMA summer program on Emerging Applications of Number Theory was aimed at stimulating further work with some of these newest and most attractive applications Concentration was on number theory's recent links with a wave phenomena in quantum mechanics more specifically quantum chaos and b graph theory especially expander graphs and related spectral theory This volume contains the contributed papers from that meeting and will be of interest to anyone intrigued by novel applications of modern number theoretical techniques

**Elementary Number Theory with Programming** Marty Lewinter, Jeanine Meyer, 2015-05-06 A highly successful presentation of the fundamental concepts of number theory and computer programming Bridging an existing gap between mathematics and programming Elementary Number Theory with Programming provides a unique introduction to elementary number theory with fundamental coverage of computer programming Written by highly qualified experts in the fields of computer science and mathematics the book features accessible coverage for readers with various levels of experience and explores number theory in the context of programming without relying on advanced prerequisite knowledge and concepts in either area Elementary Number Theory with Programming features comprehensive coverage of the methodology and applications of the most well known theorems problems and concepts in number theory Using standard mathematical applications within the programming field the book presents modular arithmetic and prime decomposition which are the basis of the public private key system of cryptography In addition the book includes Numerous examples exercises and research challenges in each chapter to encourage readers to work through the discussed concepts and ideas Select solutions to the chapter exercises in an appendix Plentiful sample computer programs to aid comprehension of the presented material for readers who have either never done any programming or need to improve their existing skill set A related website with links to select exercises An Instructor's

Solutions Manual available on a companion website Elementary Number Theory with Programming is a useful textbook for undergraduate and graduate level students majoring in mathematics or computer science as well as an excellent supplement for teachers and students who would like to better understand and appreciate number theory and computer programming The book is also an ideal reference for computer scientists programmers and researchers interested in the mathematical applications of programming *Number Theory with Computer Applications* Ramanujachary Kumanduri,Cristina Romero,1998 Appropriate for most courses in Number Theory This book effectively integrates computing algorithms into the number theory curriculum using a heuristic approach and strong emphasis on proofs Its in depth coverage of modern applications considers the latest trends and topics such as elliptic curves a subject that has seen a rise in popularity due to its use in the proof of Fermat s Last Theorem Fundamental Number Theory with Applications, Second Edition Richard A. Mollin,2008-02-21 An update of the most accessible introductory number theory text available Fundamental Number Theory with Applications Second Edition presents a mathematically rigorous yet easy to follow treatment of the fundamentals and applications of the subject The substantial amount of reorganizing makes this edition clearer and more elementary in its coverage New to the Second Edition Removal of all advanced material to be even more accessible in scope New fundamental material including partition theory generating functions and combinatorial number theory Expanded coverage of random number generation Diophantine analysis and additive number theory More applications to cryptography primality testing and factoring An appendix on the recently discovered unconditional deterministic polynomial time algorithm for primality testing Taking a truly elementary approach to number theory this text supplies the essential material for a first course on the subject Placed in highlighted boxes to reduce distraction from the main text nearly 70 biographies focus on major contributors to the field The presentation of over 1 300 entries in the index maximizes cross referencing so students can find data with ease

**Number Theory and Its Applications** Fuhuo Li,Nianliang Wang,Shigeru Kanemitsu,2013 This book emphasizes the role of symmetry and presents as many viewpoints as possible of an important phenomenon the functional equation of the associated zeta function It starts from the basics before warping into the space of new interest from the ground state to the excited state For example the Euler function is treated in several different places as the number of generators of a finite cyclic group as one counting the order of the multiplicative group of reduced residue classes modulo  $q$  and as the order and degree of the Galois group of the cyclotomic field respectively One of the important principles of learning is to work with the material many times This book presents many worked out examples and exercises to enhance the reader s comprehension on the topics covered in an in depth manner This is done in a different setting each time such that the reader will always be challenged For the keen reader even browsing the text alone without solving the exercises will yield some knowledge and enjoyment Number Theory and Its Applications Cheon Seoung Ryoo,2020 *Number Theory with Applications* James Andrew Anderson,James Milton Bell,1997 For undergraduate courses in Number Theory for mathematics computer science

and engineering majors Ideal for students of varying mathematical sophistication this text provides a self contained logical development of basic number theory supplemented with numerous applications and advanced topics

**Number Theory in Science and Communication** Manfred Schroeder, 2008-11-06 Number Theory in Science and Communication is a well known introduction for non mathematicians to this fascinating and useful branch of applied mathematics It stresses intuitive understanding rather than abstract theory and highlights important concepts such as continued fractions the golden ratio quadratic residues and Chinese remainders trapdoor functions pseudo primes and primitive elements Their applications to problems in the real world are one of the main themes of the book This revised fifth edition is augmented by recent advances in coding theory permutations and derangements and a chapter in quantum cryptography From reviews of earlier editions I continue to find Schroeder's Number Theory a goldmine of valuable information It is a marvelous book in touch with the most recent applications of number theory and written with great clarity and humor Philip Morrison Scientific American A light hearted and readable volume with a wide range of applications to which the author has been a productive contributor useful mathematics outside the formalities of theorem and proof Martin Gardner

**Algebra and Number Theory** Martyn R. Dixon, Leonid A. Kurdachenko, Igor Ya Subbotin, 2010-09-27 Explore the main algebraic structures and number systems that play a central role across the field of mathematics Algebra and number theory are two powerful branches of modern mathematics at the forefront of current mathematical research and each plays an increasingly significant role in different branches of mathematics from geometry and topology to computing and communications Based on the authors extensive experience within the field Algebra and Number Theory has an innovative approach that integrates three disciplines linear algebra abstract algebra and number theory into one comprehensive and fluid presentation facilitating a deeper understanding of the topic and improving readers retention of the main concepts The book begins with an introduction to the elements of set theory Next the authors discuss matrices determinants and elements of field theory including preliminary information related to integers and complex numbers Subsequent chapters explore key ideas relating to linear algebra such as vector spaces linear mapping and bilinear forms The book explores the development of the main ideas of algebraic structures and concludes with applications of algebraic ideas to number theory Interesting applications are provided throughout to demonstrate the relevance of the discussed concepts In addition chapter exercises allow readers to test their comprehension of the presented material Algebra and Number Theory is an excellent book for courses on linear algebra abstract algebra and number theory at the upper undergraduate level It is also a valuable reference for researchers working in different fields of mathematics computer science and engineering as well as for individuals preparing for a career in mathematics education

**Algebraic Number Theory** Richard A. Mollin, 1999-03-16 From its history as an elegant but abstract area of mathematics algebraic number theory now takes its place as a useful and accessible study with important real world practicality Unique among algebraic number theory texts this important work offers a wealth of applications to

cryptography including factoring primality testing and public key cryptosystems A follow up to Dr Mollin's popular Fundamental Number Theory with Applications Algebraic Number Theory provides a global approach to the subject that selectively avoids local theory Instead it carefully leads the student through each topic from the level of the algebraic integer to the arithmetic of number fields to ideal theory and closes with reciprocity laws In each chapter the author includes a section on a cryptographic application of the ideas presented effectively demonstrating the pragmatic side of theory In this way Algebraic Number Theory provides a comprehensible yet thorough treatment of the material Written for upper level undergraduate and graduate courses in algebraic number theory this one of a kind text brings the subject matter to life with historical background and real world practicality It easily serves as the basis for a range of courses from bare bones algebraic number theory to a course rich with cryptography applications to a course using the basic theory to prove Fermat's Last Theorem for regular primes Its offering of over 430 exercises with odd numbered solutions provided in the back of the book and even numbered solutions available a separate manual makes this the ideal text for both students and instructors



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