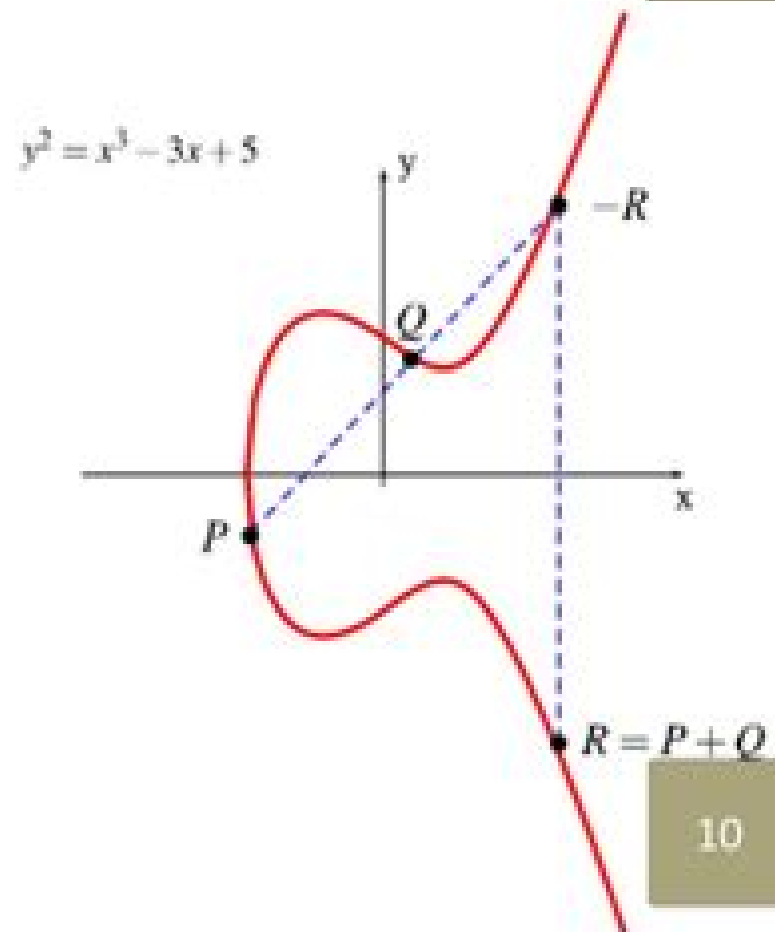# Elliptic Curve Cryptography

- Elliptical Curve Cryptography (ECC) is a newer public key encryption system (1985) using elliptic curves instead of prime numbers

- Some say 164 bit key is equivalent to other systems 1024 bit key (another say 256 bit = 3076 RSA bits)

- 112-bit key ECC broken using 200 Playstation 3s running continuously for 3.5 months.

- G=start point per curve

- k=random private key, public key=kG

$$y^2 = x^3 - 3x + 5$$

10

Source: http://en.wikipedia.org/wiki/Elliptic_curve_cryptography#Cryptographic_schemes

Elliptic Curve Public Key Cryptosystems

Hideki Imai,Yuliang Zheng

Elliptic Curve Public Key Cryptosystems:

 Elliptic Curve Public Key Cryptosystems Alfred J. Menezes,2012-12-06 Elliptic curves have been intensively studied in algebraic geometry and number theory In recent years they have been used in devising efficient algorithms for factoring integers and primality proving and in the construction of public key cryptosystems Elliptic Curve Public Key Cryptosystems provides an up to date and self contained treatment of elliptic curve based public key cryptology Elliptic curve cryptosystems potentially provide equivalent security to the existing public key schemes but with shorter key lengths Having short key lengths means smaller bandwidth and memory requirements and can be a crucial factor in some applications for example the design of smart card systems The book examines various issues which arise in the secure and efficient implementation of elliptic curve systems Elliptic Curve Public Key Cryptosystems is a valuable reference resource for researchers in academia government and industry who are concerned with issues of data security Because of the comprehensive treatment the book is also suitable for use as a text for advanced courses on the subject   Guide to Elliptic Curve Cryptography Darrel Hankerson,Alfred J. Menezes,Scott Vanstone,2004-01-08 After two decades of research and development elliptic curve cryptography now has widespread exposure and acceptance Industry banking and government standards are in place to facilitate extensive deployment of this efficient public key mechanism Anchored by a comprehensive treatment of the practical aspects of elliptic curve cryptography ECC this guide explains the basic mathematics describes state of the art implementation methods and presents standardized protocols for public key encryption digital signatures and key establishment In addition the book addresses some issues that arise in software and hardware implementation as well as side channel attacks and countermeasures Readers receive the theoretical fundamentals as an underpinning for a wealth of practical and accessible knowledge about efficient application Features Benefits Breadth of coverage and unified integrated approach to elliptic curve cryptosystems Describes important industry and government protocols such as the FIPS 186 2 standard from the U S National Institute for Standards and Technology Provides full exposition on techniques for efficiently implementing finite field and elliptic curve arithmetic Distills complex mathematics and algorithms for easy understanding Includes useful literature references a list of algorithms and appendices on sample parameters ECC standards and software tools This comprehensive highly focused reference is a useful and indispensable resource for practitioners professionals or researchers in computer science computer engineering network design and network data security   **Elliptic Curves and Their Applications to Cryptography** Andreas Enge,2012-12-06 Since their invention in the late seventies public key cryptosystems have become an indispensable asset in establishing private and secure electronic communication and this need given the tremendous growth of the Internet is likely to continue growing Elliptic curve cryptosystems represent the state of the art for such systems Elliptic Curves and Their Applications to Cryptography An Introduction provides a comprehensive and self contained introduction to elliptic curves and how they are employed to secure public key

cryptosystems Even though the elegant mathematical theory underlying cryptosystems is considerably more involved than for other systems this text requires the reader to have only an elementary knowledge of basic algebra The text nevertheless leads to problems at the forefront of current research featuring chapters on point counting algorithms and security issues The Adopted unifying approach treats with equal care elliptic curves over fields of even characteristic which are especially suited for hardware implementations and curves over fields of odd characteristic which have traditionally received more attention Elliptic Curves and Their Applications An Introduction has been used successfully for teaching advanced undergraduate courses It will be of greatest interest to mathematicians computer scientists and engineers who are curious about elliptic curve cryptography in practice without losing the beauty of the underlying mathematics **Public Key Cryptography** Kwangjo Kim,2003-06-29 This book constitutes the refereed proceedings of the 4th International Workshop on Practice and Theory in Public Key Cryptography PKC 2001 held in Cheju Island Korea in February 2001 The 30 revised full papers presented were carefully reviewed and selected from 67 submissions The papers address all current issues in public key cryptography ranging from mathematical foundations to implementation issues **Public Key Cryptography - PKC 2003** Yvo Desmedt,2002-12-13 This book constitutes the refereed proceedings of the 6th International Workshop on Practice and Theory in Public Key Cryptosystems PKC 2003 held in Miami Florida USA in January 2003 The 26 revised full papers presented were carefully reviewed and selected from 105 submissions The papers are organized in topical sections on Diffie Hellman based schemes threshold cryptography reduction proofs broadcast and tracing digital signatures specialized multiparty cryptography cryptanalysis elliptic curves implementation attacks implementation and hardware issues new public key schemes and elliptic curves general issues **Public Key Cryptosystems** Esra Bas,2024-12-30 This book is a short book about public key cryptosystems digital signature algorithms and their basic cryptanalysis which are provided at a basic level so that it can be easy to understand for the undergraduate engineering students who can be defined as the core audience To provide the necessary background Chapters 1 and 2 are devoted to the selected fundamental concepts in cryptography mathematics and selected fundamental concepts in cryptography Chapter 3 is devoted to discrete logarithm problem DLP DLP related public key cryptosystems digital signature algorithms and their cryptanalysis In this chapter the elliptic curve counterparts of the algorithms and the basic algorithms for the solution of DLP are also given In Chapter 4 RSA public key cryptosystem RSA digital signature algorithm the basic cryptanalysis approaches and the integer factorization methods are provided Chapter 5 is devoted to GGH and NTRU public key cryptosystems GGH and NTRU digital signature algorithms and the basic cryptanalysis approaches whereas Chapter 6 covers other topics including knapsack cryptosystems identity based public key cryptosystems identity based digital signature algorithms Goldwasser Micali probabilistic public key cryptosystem and their cryptanalysis The book s distinctive features The book provides some fundamental mathematical and conceptual preliminaries required to understand the core parts of the book The book comprises the selected public key

cryptosystems digital signature algorithms and the basic cryptanalysis approaches for these cryptosystems and algorithms The cryptographic algorithms and most of the solutions of the examples are provided in a structured table format to support easy learning The concepts and algorithms are illustrated with examples some of which are revisited multiple times to present alternative approaches The details of the topics covered in the book are intentionally not presented however several references are provided at the end of each chapter so that the reader can read those references for more details

   Quantum Attacks on Public-Key Cryptosystems Song Y. Yan,2014-07-08 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   **Public-Key Cryptography: Theory and Practice: Theory and Practice** Das, Abhijit,Veni Madhavan, C. E.,2004 Public Key Cryptography Theory and Practice 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 cryptogra   **Public Key Cryptography** Lynn Margaret Batten,2013-01-08 Complete coverage of the current major public key cryptosystems their underlying mathematics and the most common techniques used in attacking them Public Key Cryptography Applications and Attacks introduces and explains the fundamentals of public key cryptography and explores its application in all major public key cryptosystems in current use including ElGamal RSA Elliptic Curve and digital signature schemes It provides the underlying mathematics needed to build and study these schemes as needed and examines attacks on said schemes via the mathematical problems on which they are based such as the discrete logarithm problem and the difficulty of factoring integers The book contains approximately ten examples with detailed solutions while each chapter includes forty to fifty problems with full solutions for odd numbered problems provided in the Appendix Public Key Cryptography Explains fundamentals of public key cryptography Offers numerous examples and exercises Provides excellent study tools for those preparing to take the Certified Information Systems Security Professional CISSP exam Provides solutions to the end of chapter problems Public Key Cryptography provides a solid background for anyone who is employed by or seeking employment with a government organization cloud service provider or any large enterprise that uses public key systems to secure data   **Public Key Cryptography** Hideki Imai,Yuliang Zheng,1998-06-24 The intricate 3D structure of the CNS lends itself to multimedia presentation and is depicted

here by way of dynamic 3D models that can be freely rotated and in over 200 illustrations taken from the successful book The Human Central Nervous System by R Nieuwenhuys et al allowing the user to explore all aspects of this complex and fascinating subject All this fully hyperlinked with over 2000 specialist terms Optimal exam revision is guaranteed with the self study option For further information please contact http www brainmedia de html frames pr pr 5 pr 5 02 html

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   **Public-key Cryptography** Abhijit Das,C. E. Veni Madhavan,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   Public-Key Cryptography Daniel Lieman,2005 This collection of articles grew out of an expository and tutorial conference on public key cryptography held at the Joint Mathematics Meetings Baltimore The book provides an introduction and survey on public key cryptography for those with considerable mathematical maturity and general mathematical knowledge Its goal is to bring visibility to the cryptographic issues that fall outside the scope of standard mathematics These mathematical expositions are intended for experienced mathematicians who are not well acquainted with the subject The book is suitable for graduate students researchers and engineers interested in mathematical aspects and applications of public key cryptography

Towards a Quarter-Century of Public Key Cryptography Neal Koblitz,2013-03-09 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   Public Key Cryptography – PKC 2008 Ronald Cramer,2008-02-26 This book contains the proceedings of the 11th International Workshop on Practice and Theory in Public

Key Cryptography Coverage includes algebraic and number theoretical cryptoanalysis theory of public key encryption and public key encryption   **Public Key Cryptography - PKC 2003** Yvo Desmedt,2003-07-01 This book constitutes the refereed proceedings of the 6th International Workshop on Practice and Theory in Public Key Cryptosystems PKC 2003 held in Miami Florida USA in January 2003 The 26 revised full papers presented were carefully reviewed and selected from 105 submissions The papers are organized in topical sections on Diffie Hellman based schemes threshold cryptography reduction proofs broadcast and tracing digital signatures specialized multiparty cryptography cryptanalysis elliptic curves implementation attacks implementation and hardware issues new public key schemes and elliptic curves general issues

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   Multivariate Public Key Cryptosystems Jintai Ding,Jason E. Gower,Dieter S. Schmidt,2006-11-24 Multivariate public key cryptosystems MPKC is a fast developing new area in cryptography In the past 10 years MPKC schemes have increasingly been seen as a possible alternative to number theoretic based cryptosystems such as RSA as they are generally more efficient in terms of computational effort As quantum computers are developed MPKC will become a necessary alternative Multivariate Public Key Cryptosystems systematically presents the subject matter for a broad audience Information security experts in industry can use the book as a guide for understanding what is needed to implement these cryptosystems for practical applications and researchers in both computer science and mathematics will find this book a good starting point for exploring this new field It is also suitable as a textbook for advanced level students Written more from a computational perspective the authors provide the necessary mathematical theory behind MPKC students with some previous exposure to abstract algebra will be well prepared to read and understand the material   **Public-Key**

Cryptography – PKC 2024 Qiang Tang,Vanessa Teague,2024-04-13 The four volume proceedings set LNCS 14601 14604 constitutes the refereed proceedings of the 27th IACR International Conference on Practice and Theory of Public Key Cryptography PKC 2024 held in Sydney NSW Australia April 15 17 2024 The 54 papers included in these proceedings were carefully reviewed and selected from 176 submissions They focus on all aspects of signatures attacks commitments multiparty computation zero knowledge proofs theoretical foundations isogenies and applications lattices and applications Diffie Hellman and applications encryption homomorphic encryption and implementation

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