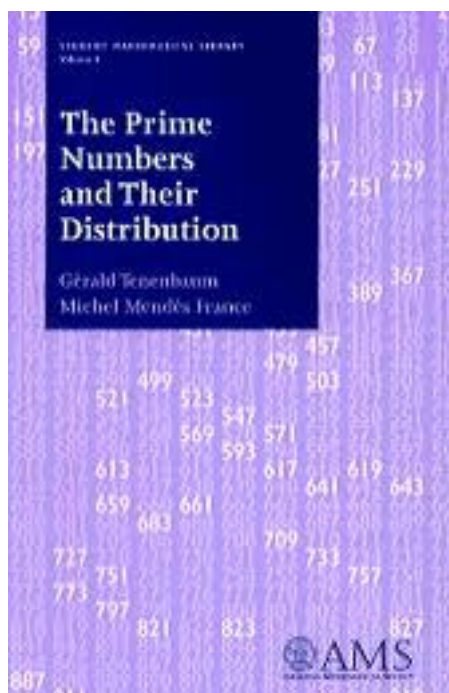


Prime Numbers and Their Distribution



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We have been curious about numbers—and prime numbers—since antiquity. One notable new direction this century in the study of primes has been the influx of ideas from probability. The goal of this book is to provide insights into the prime numbers and to describe how a sequence so tautly determined can incorporate such a striking amount of randomness.

There are two ways in which the book is exceptional. First, some familiar topics are covered with refreshing insight and/or from new points of view. Second, interesting recent developments and ideas are presented that shed new light on the prime numbers and their distribution among the rest of the integers.

The book begins with a chapter covering some classic topics, such as quadratic residues and the Sieve of Eratosthenes. Also discussed are other sieves, primes in cryptography, twin primes, and more.

Two separate chapters address the asymptotic distribution of prime numbers. In the first of these, the familiar link between $\zeta(s)$ and the distribution of primes is covered with remarkable efficiency and intuition. The later chapter presents a walk through an elementary proof of the Prime Number Theorem. To help the novice understand the “why” of the proof, connections are made along the way with more familiar results such as Stirling's formula.

A most distinctive chapter covers the stochastic properties of prime numbers. The authors present a wonderfully clever interpretation of primes in arithmetic progressions as a phenomenon in probability. They also describe Cramér's model, which provides a probabilistic intuition for formulating conjectures that have a habit of being true. In this context, they address interesting questions about equipartition modulo 1 for sequences involving prime numbers. The final section of the chapter compares geometric visualizations of random sequences with the visualizations for similar sequences derived from the primes. The resulting pictures are striking and illuminating. The book concludes with a chapter on the outstanding big conjectures about prime numbers.

This book is suitable for anyone who has had a little number theory and some advanced calculus involving estimates. Its engaging style and invigorating point of view will make refreshing reading for advanced undergraduates through research mathematicians. This book is the English translation of the French edition.

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目录: Cover 1

Title 6

Copyright 7

Contents 8

Preface to the English Edition 10

Preface to the French Edition 12

Notation and conventions 18

Chapter 1. Genesis: From Euclid to Chebyshev 22

§ 0. Introduction 22

§ 1. Canonical decomposition 25

§ 2. Congruences 26

§ 3. Cryptographic intermezzo: public key systems 29

§ 4. Quadratic residues 32

§ 5. Return to the infinitude of the set of primes 33

§ 6. The sieve of Eratosthenes 35

§ 7. The Chebyshev theorems 37

§ 8. Mertens' theorems 42

§ 9. Brun's sieve and the twin prime conjecture 46

Chapter 2. The Riemann Zeta Function 50

§ 0. Introduction	50
§ 1. Euler's product	51
§ 2. Analytic continuation	53
§ 3. The line $\sigma = 1$ and the prime number theorem	59
§ 4. The Riemann hypothesis	63
§ 5. Arithmetic consequences of information on the zeros	67
Chapter 3. Stochastic Distribution of Prime Numbers	72
§ 0. Introduction	72
§ 1. Arithmetic progressions	73
§ 2. Cramer's model	82
§ 3. Uniform distribution modulo one	88
§ 4. Geometric vision	93
Chapter 4. An Elementary Proof of the Prime Number Theorem	98
§ 0. Introduction	98
§ 1. Integration by parts	101
§ 2. Convolution of arithmetic functions	102
§ 3. The Mobius function	106
§ 4. The mean value of the Mobius function and the prime number theorem	109
§ 5. Integers free of large, or small, prime factors	113
§ 6. Dickman's function	117
§ 7. Daboussi's proof, revisited	122
Chapter 5. The Major Conjectures	126
Further reading	134
Back cover	137
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评论

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