Preface

One of the oldest and liveliest branches of mathematics, number theory is noted for its theoretical depth and applications to other fields, including representation theory, physics, and cryptography. The forefront of number theory is replete with sophisticated and famous open problems; at its foundation, however, are basic, elementary ideas that can stimulate and challenge beginning students. This textbook takes a problem-solving approach to number theory, situating each theoretical concept within the framework of some examples or some problems for readers to solve. Starting with the essentials, the text covers divisibility, powers of integers, the floor function and fractional part, digits of numbers, basic methods of proof (extremal arguments, pigeonhole principle, induction, infinite descent, inclusion–exclusion), arithmetic functions, divisibility theorems, and Diophantine equations. Emphasis is also placed on the presentation of some special problems involving quadratic residues; Fermat, Mersenne, and perfect numbers; as well as famous sequences of integers such as Fibonacci, Lucas, and those defined by recursive relations. By thoroughly discussing interesting examples and applications and by introducing and illustrating every key idea with relevant problems of various levels of difficulty, the book motivates, engages, and challenges the reader. The exposition proceeds incrementally and intuitively, and rigorously uncovers deeper properties.

A special feature of the book is an outstanding selection of genuine Olympiad and other mathematical contest problems solved using the methods already presented. The book brings about the unique and vast experience of the authors. It captures the spirit of the mathematical literature and distills the essence of a rich problem-solving culture.

Number Theory: Structures, Examples, and Problems will appeal to senior high school and undergraduate students and their instructors, as well as to all who would like to expand their mathematical horizons. It is a source of fascinating

problems for readers at all levels and widely opens the gate to further explorations in mathematics.

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