

Epp, Discrete Mathematics: Introduction to Mathematical Reasoning, TOC

1. SPEAKING MATHEMATICALLY.

Variables. The Language of Sets. The Language of Relations and Functions.

2. THE LOGIC OF COMPOUND STATEMENTS.

Logical Form and Logical Equivalence. Conditional Statements. Valid and Invalid Arguments.

3. THE LOGIC OF QUANTIFIED STATEMENTS.

Predicates and Quantified Statements I. Predicates and Quantified Statements II. Statements with Multiple Quantifiers. Arguments with Quantified Statements.

4. ELEMENTARY NUMBER THEORY AND METHODS OF PROOF.

Direct Proof and Counterexample I: Introduction. Direct Proof and Counterexample II: Rational Numbers. Direct Proof and Counterexample III: Divisibility. Direct Proof and Counterexample IV: Division into Cases and the Quotient-Remainder Theorem. Indirect Argument: Contradiction and Contraposition. Indirect Argument: Two Classical Theorems.

5. SEQUENCES, MATHEMATICAL INDUCTION, AND RECURSION.

Sequences. Mathematical Induction I. Mathematical Induction II. Strong Mathematical Induction and the Well-Ordering Principle. Defining Sequences Recursively. Solving Recurrence Relations by Iteration.

6. SET THEORY.

Set Theory: Definitions and the Element Method of Proof. Set Identities. Disproofs and Algebraic Proofs. Boolean Algebras and Russell's Paradox.

7. PROPERTIES OF FUNCTIONS.

Functions Defined on General Sets. One-to-one, Onto, and Inverse Functions. Composition of Functions. Cardinality and Sizes of Infinity.

8. PROPERTIES OF RELATIONS.

Relations on Sets. Reflexivity, Symmetry, and Transitivity. Equivalence Relations. Modular Arithmetic and \mathbb{Z}_n . The Euclidean Algorithm and Applications.

9. COUNTING.

Counting and Probability. The Multiplication Rule. Counting Elements of Disjoint Sets: The Addition Rule. The Pigeonhole Principle. Counting Subsets of a Set: Combinations. Pascal's Formula and the Binomial Theorem.

10. GRAPHS AND TREES.

Graphs: An Introduction. Trails, Paths, and Circuits. Matrix Representations of Graphs. Isomorphisms of Graphs. Trees: Examples and Basic Properties. Rooted Trees.