Contents

to as

d, n,

it. id id C,

d

Contents	v
Preface to the Third Edition	ix
Preface to the Second Edition	xi
Preface to the First Edition	xiii
List of Symbols	xvii
Chapter 1: Logic	1
1.1 Propositions and Truth Values	1
1.2 Logical Connectives and Truth Tables	2
1.3 Tautologies and Contradictions	13
1.4 Logical Equivalence and Logical Implication	15
1.5 The Algebra of Propositions	22
1.6 Arguments	26
1.7 Formal Proof of the Validity of Arguments	29
1.8 Predicate Logic	35
1.9 Arguments in Predicate Logic	45
Chapter 2: Mathematical Proof	50
2.1 The Nature of Proof	50
2.2 Axioms and Axiom Systems	5
2.3 Methods of Proof	5.
2.4 Mathematical Induction	69
Chapter 3: Sets	75
3.1 Sets and Membership	7
3.2 Subsets	8.

	~
V1	Contents

3.3	Operations on Sets	91
3.4		100
3.5	The Algebra of Sets	104
3.6	Families of Sets	111
3.7	The Cartesian Product	122
3.8	Types and Typed Set Theory	134
Chapte	er 4: Relations	154
4.1	Relations and Their Representations	154
4.2	Properties of Relations	164
4.3	Intersections and Unions of Relations	171
4.4	Equivalence Relations and Partitions	175
4.5	Order Relations	188
4.6	Hasse Diagrams	198
4.7	Application: Relational Databases	205
Chapte	r 5: Functions	220
5.1	Definitions and Examples	220
5.2	Composite Functions	238
5.3	Injections and Surjections	246
5.4	Bijections and Inverse Functions	260
5.5	More on Cardinality	270
5.6	Databases: Functional Dependence and Normal Forms	277
Chapte	r 6: Matrix Algebra	291
6.1	Introduction	291
6.2	Some Special Matrices	294
6.3	Operations on Matrices	296
6.4	Elementary Matrices	308
6.5	The Inverse of a Matrix	318
Chapte	r 7: Systems of Linear Equations	331
7.1	Introduction	331
7.2	Matrix Inverse Method	337
7.3	Gauss-Jordan Elimination	342
7.4	Gaussian Elimination	355
Chapte	r 8: Algebraic Structures	361
8.1	Binary Operations and Their Properties	361
8.2	Algebraic Structures	370
8.3	More about Groups	379
8.4	Some Families of Groups	384
8.5	Substructures	396
8.6	Morphisms	404
8.7	Group Codes	418

	Co	ontents vii
Chanter	9: Introduction to Number Theory	436
	Divisibility	437
	Prime Numbers	449
100000000000000000000000000000000000000	Linear Congruences	460
	Groups in Modular Arithmetic	473
	Public Key Cryptography	479
Chapter	10: Boolean Algebra	492
10.1	Introduction	492
10.2	Properties of Boolean Algebras	496
10.3	Boolean Functions	503
10.4	Switching Circuits	520
10.5	Logic Networks	529
10.6	Minimization of Boolean Expressions	536
Chapter	11: Graph Theory	548
11.1	Definitions and Examples	548
11.2	Paths and Cycles	561
11.3	Isomorphism of Graphs	575
11.4	Trees	582
11.5	Planar Graphs	591
11.6	Directed Graphs	600
Chapter	12: Applications of Graph Theory	611
12.1	Introduction	611
12.2	Rooted Trees	612
12.3	Sorting	626
12.4	Searching Strategies	643
12.5	Weighted Graphs	652
	The Shortest Path and Travelling Salesman Problems	
12.7	Networks and Flows	673
Referen	ces and Further Reading	687
Hints an	nd Solutions to Selected Exercises	692
Index		798