

CONTENTS

Chapter 1 SETS, NUMBERS, AND ALGORITHMS 1

- 1.1 Defining Sets and Subsets 2
- 1.2 Sets and Functions 9
- 1.3 Sums and Algorithms 16
- 1.4 Integers and Algorithms 24
- 1.5 Rational and Real Numbers 31
- 1.6 Other Systems of Numeration 39
- 1.7 Binary Arithmetic and Two's Complements 47
- 1.8 Modular Arithmetic 54
- Computer Programming Exercises 63

Chapter 2 SETS, LOGIC, AND COMPUTER ARITHMETIC 65

- 2.1 Examples, Counterexamples, and Mathematical Induction 66
- 2.2 Set Operations 73
- 2.3 The Algebra of Set Operations 82
- 2.4 Truth Sets and Truth Tables 88

2.5	Laws of Logic and Rules of Reasoning	96
2.6	Logic Gates and Computer Arithmetic	103
	Computer Programming Exercises	112

Chapter 3 COUNTING 115

3.1	The Multiplication Principle and Permutations	116
3.2	Combinations and Binomial Coefficients	124
3.3	Repetitions and Partitions	130
3.4	Inclusion–Exclusion	136
3.5	Applications of Counting from Probability to Pigeonholes	143
3.6	Recurrence Models	150
3.7	Closed Forms and Analysis of Algorithms	158
3.8	Divide-And-Conquer Relations	167
	Computer Programming Exercises	173

Chapter 4 INTRODUCTION TO GRAPH THEORY 175

4.1	Graphs and Walks	176
4.2	Classification of Graphs	187
4.3	Planar Graphs and Euler’s Formula	197
4.4	Graph Coloring	205
4.5	Multigraphs and Matrices	212
4.6	Matrix Multiplication and Connectedness	220
	Computer Programming Exercises	229

Chapter 5 TREES AND ALGORITHMS 231

5.1	Weighted Graphs and the Connector Problem	232
5.2	The Shortest Path Problem	242
5.3	Rooted Trees and Polish Notation	250
5.4	Binary Search Trees	261
	Computer Programming Exercises	267

Chapter 6 DIRECTED GRAPHS AND NETWORKS 269

- 6.1 Digraphs 270
- 6.2 Orientable Graphs and Topological Sorting 279
- 6.3 Activity Analysis and Longest Paths 288
- 6.4 Transport Networks 296
- 6.5 Maximal Matchings 307
- Computer Programming Exercises 313

Chapter 7 APPLIED MODERN ALGEBRA 315

- 7.1 Relations 316
- 7.2 Equivalence Relations and Partitions 326
- 7.3 Partial Orderings and Dilworth's Theorem 336
- 7.4 Lattices 342
- 7.5 Boolean Algebras 351
- 7.6 Minimization and Switching Circuits 360
- 7.7 Groups 370
- 7.8 Group Codes 377
- Computer Programming Exercises 383

Chapter 8 FURTHER TOPICS IN COUNTING AND RECURSION 385

- 8.1 Homogeneous Linear Recurrence Relations 386
- 8.2 The Nonhomogeneous Case 393
- 8.3 Generating Functions and Recurrence Relations 398
- 8.4 Generating Functions and Counting 410
- Computer Programming Exercises 419

Appendix PROGRAMS IN BASIC AND EXERCISES 421

- | | |
|-----------------------------------|-----------------------------|
| A1 BASIC Statements 422 | A6 PRIMETEST 427 |
| A2 More BASIC Statements 423 | A7 SIEVE 428 |
| A3 FIBONACCI 425 | A8 PARTITION 429 |
| A4 NESTED POLY 1 426 | A9 SETS AND BINARY 430 |
| A5 NESTED POLY 2 426 | A10 N FACTORIAL 431 |

A11	BINOMIAL	431	A19	EULER T/C	440
A12	BIRTHDAY	432	A20	MIN COST TREE	442
A13	BUBLSORT	433	A21	DFS SPAN TREE	445
A14	MATRIX ARRAY	434	A22	TOPL SORT	446
A15	MATRIX ADD	434	A23	TRANS TEST	448
A16	MATMULT	435	A24	SYMTRANSTEST	449
A17	VERTEX DEG	437	A25	LOGIC TABLE	450
A18	PATH MATRIX	438			

Bibliography 453

Answers to Selected Exercises 455

Index 483