Contents

CHAPTER

Preliminaries

Subscripts and superscripts 2 2 3 The three dots notation 2 What is finite mathematics? 4 5 Prime numbers 5 The absolute value notation 5 7 The proof is completed 6 More minor items 6 CHAPTER 1 Statements 8 Logic 2 Symbols for the three simplest connectives 10 3 Truth tables 13 4 Two more connectives 18 5 Tautology and contradiction 6 Implication and equivalence 23 7 On the validity of an argument 29 Design of switching networks 34 İΧ

1

Mathematical symbols 1

CHAPTER

2

The Algebra of Sets

- 1 The concept of a set 39
- 2 Subsets and supersets 44
- 3 Unions and intersections of sets 45
- 4 The complement of a set 51
- 5 The distributive laws for sets 55
- 6 The number of elements in a set 61
- 7 Tree diagrams 70
- *8 The relation between set theory and logic 75
- *9 Voting coalitions 77

CHAPTER

3

Elementary Combinatorial

Analysis
80

- 1 Two simple examples 80
- 2 Permutations and the factorial notation 83
- 3 Combinations 89
- 4 More difficult problems 93

CHAPTER



98

X

The Binomial Theorem and Related Topics

- 1 The ∑ notation 98
- *2 The II notation 103
- 3 The binomial theorem 105
- 4 The Pascal triangle 112
- 5 Partitions 113
- 6 The multinomial theorem 119
- *7 A general counting theorem 123

* * * * * * * * * * * * * * * * * * * *	
Probability	
129	

Some simple examples 12	29
-------------------------	----

- Sample spaces 138
- ***3** Games 142
- ***4** The Kaos problem 147
- 5 Conditional probability 149
- 6 Independent events 158
- **★7** Bayes' theorem 162
 - Bernoulli trials 168
- Expected value 173
- *10 Odds 183
- *11 The birthday paradox 185
- *12 Keno 187

CHAPTER

Further Topics in

Probability



191

- 1 Stochastic processes 191
- 2 Markov chains 196
- *3 Gambler's ruin 202
- *4 Testing a hypothesis 210
- *****5 The law of large numbers 216
- ***6** The DeMoivre-Laplace limit theorem 218

CHAPTER

- 1 Vectors 228
- Geometric representation of a vector 234
- The multiplication of vectors 240 3
- 4 Matrices 243
- 5 Addition of matrices 248

Vectors and **Matrices**

228

ΧÌ

- 6 Multiplication of matrices 251
- *7 The transpose of a matrix 258

CHAPTER

Applications of Matrices

- 1 Systems of linear equations 261
- 2 The inverse of a matrix 272
- 3 Markov chains 280
- 4 Absorbing Markov chains 290
- *5 Genetics 299

CHAPTER



convex Sets and Linear Programming 305

- 1 Convex sets 305
- 2 Linear programming 314
- *3 The simplex method 322

CHAPTER



The Theory of Games

- 1 Matrix games 336
- 2 The value of a game 341
- 3 Strictly determined games 346
- 4 2×2 matrix games 350
- 5 $m \times n$ matrix games 355

CHAPTER



Applications to the Social Sciences 362

- 1 Theories and models 362
- 2 A model for paired-associate learning 363
- 3 The Leontief input-output model 374

1 2 3 4 5 *6 7	Graphs and their representations 388 Digraphs 394 Distances in a graph 400 Tournaments 404 The detection of cliques 410 An open problem in graph theory 416 The Königsberg bridge problem and generalizations 419	Graph Theory and Its Applications 388
1 2 3	The concept of a function 425 Function notation 429 The graph of a function 431	Functions and Function Notation

		J.
1	The elementary theorems 437	Inequalities
2	Conditional inequalities 446	437

APPENDIX

1	The nature of mathematical induction	449	Mathematical
2	The general principle 452		Induction 449

3 Further examples 453

2 Conditional inequalities 446

4 The modern definition of a function 435

APPENDIX

APPENDIX

Gambler's Ruin 457

Tables 462

A Binomial coefficients $\binom{n}{k} = C(n,k)$ 462

B Values of b(k,n,p) 464

C Areas under the unit normal curve 466

Answers to Exercises

469

Index of Selected Symbols

528

Index

531