Contents

	Pref	ace	V	
	Nota	ation and Abbreviation	vii	
	Con	tents	хi	
1.	Permutations and Combinations			
	1.1.	Two Basic Counting Principles	1	
	1.2.	Permutations	6	
	1.3.	Circular Permutations	12	
	1.4.	Combinations	17	
	1.5.	The Injection and Bijection Principles	27	
	1.6.	Arrangements and Selections with Repetitions	32	
	1.7.	Distribution Problems	40	
	Exe	rcise 1	50	
2.	Binomial Coefficients and Multinomial Coefficients 69			
	2.1.	Introduction	69	
	2.2 .	The Binomial Theorem	70	
	2.3.	Combinatorial Identities	71	
	2.4.	The Pascal's Triangle	76	
	2.5 .	Chu Shih-Chieh's Identity	78	
	2.6.	Shortest Routes in a Rectangular Grid	85	
	2.7.	Some Properties of Binomial Coefficients		
	2 .8.	Multinomial Coefficients and the Multinomial Theorem	96	
	Exe	rcise 2	102	
3.	The Pigeonhole Principle and Ramsey Numbers 119			
	3.1.	Introduction	119	
	3.2 .	The Pigeonhole Principle	119	
	3.3.	More Examples	122	
	3.4.	Ramsey Type Problems and Ramsey Numbers	129	
	3.5.	Bounds for Ramsey Numbers	132	
	Exe	rcise 3	137	

xii Contents

4.	The	Principle of Inclusion and Exclusion	. 145
	4.1.	Introduction	. 145
	4.2 .	The Principle	. 146
	4.3.	A Generalization	. 148
	4.4.	Integer Solutions and Shortest Routes	. 153
	4.5.	Surjective Mappings and Stirling Numbers of the Second	
		Kind	. 158
	4.6.	Derangements and A Generalization	. 160
	4.7.	The Sieve of Eratosthenes and Euler φ -function	. 163
	4.8.	The 'Probléme des Ménages'	. 169
	Exe	rcise 4	. 173
5.	Gen	erating Functions	. 185
	5.1.	Ordinary Generating Functions	
	5.2.	Some Modelling Problems	
	5.3.	Partitions of Integers	
	5.4.	Exponential Generating Functions	
	Exe	rcise 5	
6.	Rec	urrence Relations	. 225
	6.1.	Introduction	
	6.2.	Two Examples	
	6.3.	Linear Homogeneous Recurrence Relations	
	6.4.	General Linear Recurrence Relations	
	6.5.	Two Applications	
	6.6.	A System of Linear Recurrence Relations	
	6.7.	The Method of Generating Functions	
	6.8.	A Nonlinear Recurrence Relation and Catalan Numbers .	
	6.9.	Oscillating Permutations and an Exponential Generating	
		Function	. 262
	Exe	rcise 6	
	Bib	liography	. 287
		wers	
	Ind		207
	ind	D Y	7.94 /