

Contents

Note from the Translator

Preface

Foreword to the Chinese Edition

List of Symbols

Chapter 1 Basic Theory of Association Schemes	1
1.1 Definition of Association Scheme	1
1.2 Examples	4
1.3 The Eigenvalues of Association Schemes	7
1.4 The Krein Parameters	12
1.5 S-Rings and Duality	16
1.6 Primitivity and Imprimitivity	20
1.7 Subschemes and Quotient Schemes	25
1.8 The Polynomial Property	29
1.9 The Automorphisms	34
Chapter 2 Association Schemes of Rectangular Matrices	36
2.1 Definition and Primitivity	36
2.2 The Polynomial Property of Association Schemes of Rectangular Matrices ...	39
2.3 Recurrence Formulas for Intersection Numbers	42
2.4 The Duality of Association Schemes of Rectangular Matrices	48
2.5 The Automorphisms of $\text{Mat}(m \times n, q)$	50
Chapter 3 Association Schemes of Alternate Matrices	52
3.1 Primitivity and P-polynomial Property	52
3.2 The Parameters of $\Gamma^{(1)}$	54
3.3 Recurrences for Intersection Numbers	58
3.4 Recurrences for Intersection Numbers: Continued	62
3.5 The Self-duality of $\text{Alt}(n, q)$	66
3.6 The Automorphisms of $\text{Alt}(n, q)$	67
Chapter 4 Association Schemes of Hermitian Matrices	69
4.1 Primitivity and P-polynomial Property	69
4.2 The Parameters of Graph $\Gamma^{(1)}$	71
4.3 Recurrences for Intersection Numbers	74
4.4 Recurrences for Intersection Numbers: Continued	77
4.5 The Self-duality of $\text{Her}(n, q^2)$	80
4.6 The Automorphisms of $\text{Her}(n, q^2)$	81

Chapter 5 Association Schemes of Symmetric Matrices in Odd Characteristic	82
5.1 The Normal Forms of Symmetric Matrices	82
5.2 The Association Schemes of Symmetric Matrices and Their Primitivity	83
5.3 $\text{Sym}(n, q)$ for Small n	87
5.4 A Few Enumeration Formulas from Orthogonal Geometry	92
5.5 Calculation of Intersection Numbers	96
5.6 Calculation of Intersection Numbers: Continued	101
5.7 The Association Scheme $\text{Quad}(n, q)$	109
5.8 The Self-duality of $\text{Sym}(n, q)$	121
5.9 The Automorphisms of $\text{Sym}(n, q)$	122
Chapter 6 Association Schemes of Symmetric Matrices in Even Characteristic	128
6.1 The Normal Forms of Symmetric Matrices	128
6.2 The Imprimitivity of $\text{Sym}(n, q)$	129
6.3 The Association Scheme $\text{Sym}(2, q)$	130
6.4 Some Results of Pseudo-symplectic Geometry	135
6.5 Calculation of Intersection Numbers	138
6.6 Calculation of Intersection Numbers: Continued	145
6.7 A Fusion Scheme of $\text{Sym}(n, q)$	150
6.8 The Automorphisms of $\text{Sym}(n, q)$	154
Chapter 7 Association Schemes of Quadratic Forms in Even Characteristic	156
7.1 The Normal Forms of Quadratic Forms	156
7.2 $\text{Qua}(2, q)$ and $\text{Qua}(3, q)$	160
7.3 Some Enumeration Formulas from Orthogonal Geometry	166
7.4 Calculation of Intersection Numbers	172
7.5 The Duality of Association Schemes of Quadratic Forms	186
7.6 The Imprimitivity of Association Schemes of Quadratic Forms	190
7.7 Two Fusion Schemes of $\text{Qua}(n, q)$	192
7.8 The Automorphisms of Association Schemes of Quadratic Forms	199
Chapter 8 The Eigenvalues of Association Schemes of Quadratic Forms	207
8.1 The Eigenvalues of Association Scheme $\text{Qua}(2, q)$	207
8.2 Some Lemmas on Additive Characters	209
8.3 The 1-extensions and $f_r^{(n)}$	211
8.4 Values of $f_r^{(n)}$ on the Union Classes $C_{2i}^{(n)}$	215
8.5 The 2-extensions and $f_{2k^*}^{(n)}$	218
8.6 Values of $f_{2k^*}^{(n)}$ on Classes $C_{2i}^{(n)}$ and $C_{2i}^{(n)} \cup C_{2i-1}^{(n)}$	227
8.7 Dual Schemes of Two Fusion Schemes of $\text{Qua}(n, q)$	229
8.8 Eigenvalues of Small Association Schemes of Quadratic Forms	230
References	233
Index	235