

Contents

Preface	v
Chapter 1 Introduction	1
1.1 Group Testing	1
1.2 Nonadaptive Group Testing	4
1.3 Applications in Molecular Biology	7
1.4 Pooling Designs for Two Simple Applications	13
1.5 Pooling Designs and Mathematics	15
1.6 An Outline of the Book	17
References	18
Chapter 2 Basic Theory on Separating Matrices	21
2.1 d -Separable and \bar{d} -Separable Matrices	21
2.2 d -Disjunct Matrices	25
2.3 The Minimum Number of Pools for Given d and n	27
2.4 Combinatorial Bounds for d -Disjunct Matrices with Constant Weight	30
2.5 Asymptotic Lower and Upper Bounds	33
2.6 (d, r) -Disjunct Matrices	40
2.7 Error-Tolerance	45
References	52
Chapter 3 Deterministic Designs	55
3.1 t -Designs and t -Packing	55
3.2 Direct Construction	57
3.3 Explicit Construction of Selectors	59
3.4 Grid Designs	60
3.5 Error-Correcting Code	63
3.6 Transversal Designs	65

3.7 The $d = 2$ Case	70
References	79
Chapter 4 Deterministic Designs from Partial Orders	83
4.1 Subset Containment Designs	83
4.2 Partial Order of Faces in a Simplicial Complex	84
4.3 Monotone Graph Properties	90
4.4 Partial Order of Linear Spaces over a Finite Field	92
4.5 Atomic Poset	95
References	97
Chapter 5 Random Pooling Designs and Probabilistic Analysis	99
5.1 Introduction to Random Designs	99
5.2 A General Approach to Compute Probabilities of Unresolved Clones	100
5.3 Random Incidence Designs	106
5.4 Random k -Set Designs	109
5.5 Random r -Size Designs	111
5.6 Random Distinct k -Set Designs	113
5.7 Intersection Pooling Designs	115
5.8 Subset Containment Designs in Extended Use	118
5.9 Edge-Representative Decoding with $r = 2$ and $d = 3$	122
5.10 Some Trivial 2-Stage Pooling Designs	126
References	128
Chapter 6 Pooling Designs on Complexes	131
6.1 Introduction	131
6.2 A Construction of $(H : d; z)$ -Disjunct Matrix	134
6.3 $(d, r; z]$ -Disjunct Matrix	136
6.4 Constructions for $(d, r; z]$ -Disjunct Matrices	139
6.5 Random Designs	144
6.6 Trivial Two-stage Pooling Designs for Complete r -graphs	148
6.7 Sequential Algorithms for H_r	152
References	162
Chapter 7 Contig Sequencing	165
7.1 Introduction	165
7.2 Some Probability Analysis of a k -subset	166
7.3 Sequential Algorithms	170
7.4 Nonadaptive Algorithms for Matching	172
7.5 The 3-Stage Procedure	184
References	188

Chapter 8 The Inhibitor Model	189
8.1 Introduction	189
8.2 1-Round Algorithm	190
8.3 Sequential and k -Round Algorithms	193
8.4 Some Other Inhibitor Models	195
References	198
Chapter 9 Hyperplane Designs	201
9.1 Introduction	201
9.2 m -Dimensional Arrays	203
9.3 A $K_r \times K_c$ Decomposition of K_n	207
9.4 Efficiency	215
9.5 Other Transversal Designs	219
9.6 Two Recent Applications	221
References	222
Chapter 10 Non-unique Probe Selection	225
10.1 Introduction	225
10.2 Complexity of Pooling Designs	227
10.3 Complexity of Minimum Pooling Designs	228
10.4 Approximations of Minimum Pooling Designs	231
References	231
Index	233