Contents

Preface ix

Chapter 1. Some Fundamentals 1
  1.1. Nonnegative Matrices 1
  1.2. Symmetric Matrices 7
  Bibliography 11

Chapter 2. Eigenvalues of Graphs 13
  2.1. Some Basic Properties 13
  2.2. Eigenvalues and Graph Parameters 16
  2.3. Graphs with small $\lambda_{\text{max}}$ 19
  2.4. Laplacian Matrix of a Graph 21
  Bibliography 23

Chapter 3. Rado-Hall Theorem and Applications 25
  3.1. Rado-Hall Theorem 25
  3.2. Applications 27
  Bibliography 31

Chapter 4. Colin de Verdière Number 33
  4.1. Motivation and Definition 33
  4.2. Colin de Verdière Number and Graph Properties 35
  Bibliography 38

Chapter 5. Classes of Matrices of Zeros and Ones 39
  5.1. Equivalent Formulations 39
  5.2. The Classes $\mathcal{A}(R, S)$ 40
  5.3. A Generalization 45
  Bibliography 47

Chapter 6. Matrix Sign Patterns 49
  6.1. Sign-Nonsingular Matrices 49
  6.2. An Application 53
  6.3. Spectrally Arbitrary Sign Patterns 55
  Bibliography 57

Chapter 7. Eigenvalue Inclusion and Diagonal Products 59
  7.1. Some Classical Theorems 59
  7.2. Diagonal Products and Nonsingularity 62
Bibliography 66

Chapter 8. tournaments 67
  8.1. Landau’s Theorem 67
  8.2. A Special Tournament in \( T(R) \) 71
  8.3. Eigenvalues of Tournament Matrices 74
  Bibliography 76

Chapter 9. Two Matrix Polytopes 77
  9.1. The Doubly Stochastic Polytope 77
  9.2. Alternating Sign Matrices 79
  9.3. The Alternating Sign Matrix Polytope 81
  9.4. ASM Patterns 83
  Bibliography 86

Chapter 10. Digraphs and Eigenvalues of (0, 1)-matrices 87
  10.1. (0, 1)-matrices with all Eigenvalues Positive 87
  10.2. Totally Nonnegative Matrices 90
  10.3. Totally Nonnegative (0, 1)-matrices 91
  Bibliography 93

Index 95