
Contents

List of Figures	v
Preface	vii
Chapter 1. Graphs and Probability	1
§1.1. Introduction	1
§1.2. Graph Theory	2
§1.3. Probability Theory	9
Exercises	14
Chapter 2. The Web Graph	19
§2.1. Introduction	19
§2.2. Other Real-World Self-Organizing Networks	29
Exercises	31
Chapter 3. Random Graphs	33
§3.1. Introduction	33
§3.2. What is a Random Graph?	34
§3.3. Expectation and the First Moment Method	44
§3.4. Variance and the Second Moment Method	47
§3.5. Martingales and Concentration	50
Exercises	55
Chapter 4. Models for the Web Graph	59
§4.1. Introduction	59
§4.2. On-Line Web Graph Models	61

§4.3. Future Challenges in Modelling the Web Graph	92
Exercises	94
Chapter 5. Searching the Web	97
§5.1. Introduction	97
§5.2. An Overview of Search Engines	98
§5.3. Adjacency Matrices and the Perron-Frobenius Theorem	99
§5.4. Markov Chains	103
§5.5. PageRank	105
§5.6. HITS	110
§5.7. SALSA	114
§5.8. Further Analysis of Web Ranking Algorithms	115
Exercises	117
Chapter 6. The Infinite Web	121
§6.1. Introduction	121
§6.2. The Infinite Random Graph	124
§6.3. Representations and Properties of R	127
§6.4. Limits of Copying Models	132
§6.5. Limits of Preferential Attachment Models	142
§6.6. The n -Ordered Graphs and Their Limits	145
Exercises	153
Chapter 7. New Directions in Internet Mathematics	157
§7.1. Introduction	157
§7.2. Eigenvalues of Power Law Graphs	158
§7.3. Modelling Viruses on the Web	160
§7.4. Dominating Sets in the Web Graph	162
Exercises	168
Bibliography	171
Index	181