## Table of Contents

Preface to the Fifth Edition	xi
1. Introduction to Graphs	1
1.1 Graphs and Subgraphs	1
1.2 Degree Sequences	22
1.3 Connected Graphs and Distance	30
1.4 Multigraphs and Digraphs	45
2. Trees and Connectivity	55
2.1 Nonseparable Graphs	55
2.2 Trees	61
2.3 Spanning Trees	69
2.4 Connectivity and Edge-Connectivity	89
2.5 Menger's Theorem	97
3. Eulerian and Hamiltonian Graphs	107
3.1 Eulerian Graphs	107
3.2 Hamiltonian Graphs	115
3.3 Powers of Graphs and Line Graphs	137
4. Digraphs	149
4.1 Strong Digraphs	149
4.2 Tournaments	156
4.3 Flows in Networks	171
5. Graphs: History and Symmetry	195
5.1 Some Historical Figures of Graph Theory	195
5.2 The Automorphism Group of a Graph	201
5.3 Cayley Color Graphs	206
5.4 The Reconstruction Problem	212
6. Planar Graphs	221
6.1 The Euler Identity	221
6.2 Planarity versus Nonplanarity	235
6.3 The Crossing Number of a Graph	250
6.4 Hamiltonian Planar Graphs	263

7.	Graph Embeddings	269
	7.1 The Genus of a Graph	269
	7.2 2-Cell Embeddings of Graphs	281
	7.3 The Maximum Genus of a Graph	294
	7.4 The Graph Minor Theorem	307
8.	Vertex Colorings	311
	8.1 The Chromatic Number of a Graph	311
	8.2 Color-Critical Graphs	323
	8.3 Bounds for the Chromatic Number	327
	8.4 Perfect Graphs	340
	8.5 List Colorings	353
9.	Map Colorings	359
	9.1 The Four Color Problem	359
	9.2 Colorings of Planar Graphs	376
	9.3 The Conjectures of Hajós and Hadwiger	384
	9.4 Chromatic Polynomials	388
	9.5 The Heawood Map-Coloring Problem	395
10.	Matchings, Factorization and Domination	401
	10.1 Matchings and Independence in Graphs	401
	10.2 Factorization	419
	10.3 Decomposition and Graceful Graphs	427
	10.4 Domination	438
11.	Edge Colorings	447
	11.1 Chromatic Index and Vizing's Theorem	447
	11.2 Class One and Class Two Graphs	456
	11.3 Tait Colorings	464
	11.4 Nowhere-Zero Flows	473
	11.5 List Edge Colorings and Total Colorings	484
12.	Extremal Graph Theory	493
	12.1 Turán's Theorem	493
	12.2 Cages	499
	12.3 Ramsey Theory	508

Hints and Solutions to Odd-Numbered Exercises	523
Bibliography	547
Index of Names	565
Index of Mathematical Terms	571
List of Symbols	583