

Contents

Editor's Statement	xiii
Foreword	xv
Introduction	xix
Chapter I Graphs and Subgraphs	1
I.1 Definitions	1
I.2 Isomorphism	5
I.3 Subgraphs	9
I.4 Vertices of attachment	11
I.5 Components and connection	14
I.6 Deletion of an edge	18
I.7 Lists of nonisomorphic connected graphs	22
I.8 Bridges	27
I.9 Notes	30
Exercises	31
References	31
Chapter II Contractions and the Theorem of Menger	32
II.1 Contractions	32
II.2 Contraction of an edge	37
II.3 Vertices of attachment	41

II.4	Separation numbers	43
II.5	Menger's Theorem	46
II.6	Hall's Theorem	50
II.7	Notes	52
	Exercises	53
	References	53
Chapter III	2-Connection	54
III.1	Separable and 2-connected graphs	54
III.2	Constructions for 2-connected graphs	56
III.3	Blocks	60
III.4	Arms	64
III.5	Deletion and contraction of an edge	66
III.6	Notes	68
	Exercises	68
	References	69
Chapter IV	3-Connection	70
IV.1	Multiple connection	70
IV.2	Some constructions for 3-connected graphs	74
IV.3	3-blocks	83
IV.4	Cleavages	95
IV.5	Deletions and contractions of edges	104
IV.6	The Wheel Theorem	111
IV.7	Notes	113
	Exercises	114
	References	114
Chapter V	Reconstruction	115
V.1	The Reconstruction Problem	115
V.2	Theory and practice	118
V.3	Kelly's Lemma	119
V.4	Edge-reconstruction	122
V.5	Notes	123
	Exercises	124
	References	124
Chapter VI	Digraphs and Paths	125
VI.1	Digraphs	125
VI.2	Paths	129
VI.3	The BEST Theorem	133
VI.4	The Matrix-Tree Theorem	138

VI.5	The Laws of Kirchhoff	142
VI.6	Identification of vertices	149
VI.7	Transportation Theory	152
VI.8	Notes	158
	Exercises	159
	References	159
Chapter VII	Alternating Paths	161
VII.1	Cursality	161
VII.2	The bicursal subgraph	163
VII.3	Bicursal units	167
VII.4	Alternating barriers	168
VII.5	f -factors and f -barriers	170
VII.6	The f -factor theorem	174
VII.7	Subgraphs of minimum deficiency	178
VII.8	The bipartite case	180
VII.9	A theorem of Erdős and Gallai	181
VII.10	Notes	183
	Exercises	183
	References	184
Chapter VIII	Algebraic Duality	185
VIII.1	Chain-groups	185
VIII.2	Primitive chains	188
VIII.3	Regular chain-groups	194
VIII.4	Cycles	197
VIII.5	Coboundaries	200
VIII.6	Reductions and contractions	204
VIII.7	Algebraic duality	206
VIII.8	Connectivity	209
VIII.9	On transportation theory	215
VIII.10	Incidence matrices	217
VIII.11	Matroids	218
VIII.12	Notes	219
	Exercises	219
	References	220
Chapter IX	Polynomials Associated with Graphs	221
IX.1	V -functions	221
IX.2	The chromatic polynomial	226
IX.3	Colorings of graphs	233
IX.4	The flow polynomial	237

IX.5	Tait colorings	240
IX.6	The dichromate of a graph	243
IX.7	Some remarks on reconstruction	248
IX.8	Notes	250
	Exercises	251
	References	251
Chapter X	Combinatorial Maps	253
X.1	Definitions and preliminary theorems	253
X.2	Orientability	257
X.3	Duality	259
X.4	Isomorphism	261
X.5	Drawings of maps	263
X.6	Angles	268
X.7	Operations on maps	268
X.8	Combinatorial surfaces	275
X.9	Cycles and coboundaries	281
X.10	Notes	283
	Exercises	284
	References	284
Chapter XI	Planarity	285
XI.1	Planar graphs	285
XI.2	Spanning subgraphs	288
XI.3	Jordan's Theorem	290
XI.4	Connectivity in planar maps	296
XI.5	The cross-cut Theorem	306
XI.6	Bridges	311
XI.7	An algorithm for planarity	314
XI.8	Peripheral circuits in 3-connected graphs	317
XI.9	Kuratowski's Theorem	320
XI.10	Notes	325
	Exercises	325
	References	326
	Index	327