

Contents

CHAPTER 1	MATHEMATICAL MODELS	1
Section 1.1	Applying Mathematics	1
Section 1.2	The Diet Problem	3
Section 1.3	The Prisoner's Dilemma	5
Section 1.4	Roles of Linear Programming and Game Theory	8
CHAPTER 2	THE LINEAR PROGRAMMING MODEL	11
Section 2.1	History	11
Section 2.2	The Blending Model	12
Section 2.3	The Production Model	18
Section 2.4	The Transportation Model	26
Section 2.5	The Dynamic Planning Model	29
Section 2.6	Summary	35
CHAPTER 3	THE SIMPLEX METHOD	43
Section 3.1	The General Problem	43
Section 3.2	Linear Equations and Basic Feasible Solutions	49
Section 3.3	Introduction to the Simplex Method	60
Section 3.4	Theory of the Simplex Method	64
Section 3.5	The Simplex Tableau and Examples	72
Section 3.6	Artificial Variables	80
Section 3.7	Redundant Systems	88
Section 3.8	A Convergence Proof	93
Section 3.9	Linear Programming and Convexity	97
CHAPTER 4	DUALITY	103
Section 4.1	Definition of the Dual Problem	103
Section 4.2	Examples and Interpretations	109
Section 4.3	The Duality Theorem	117

CHAPTER 5	SENSITIVITY ANALYSIS	127
Section 5.1	Examples in Sensitivity Analysis	127
Section 5.2	Matrix Representation of the Simplex Tableau	135
Section 5.3	Changes in the Objective Function	142
Section 5.4	Addition of a New Variable	146
Section 5.5	Changes in the Constant Column Vector	148
Section 5.6	The Dual Simplex Algorithm	150
Section 5.7	Addition of a Constraint	159
CHAPTER 6	INTEGER PROGRAMMING	163
Section 6.1	Introduction to Integer Programming	163
Section 6.2	Models with Integer Programming Formulations	167
Section 6.3	Gomory's Cutting Plane Algorithm	177
Section 6.4	A Branch and Bound Algorithm	187
CHAPTER 7	THE TRANSPORTATION PROBLEM AND OTHER TOPICS	195
Section 7.1	A Distribution Problem	195
Section 7.2	The Transportation Problem	209
Section 7.3	The Assignment Problem	228
Section 7.4	An Example Involving Uncertainty	235
CHAPTER 8	TWO-PERSON, ZERO-SUM GAMES	243
Section 8.1	Introduction to Game Theory	243
Section 8.2	Some Principles of Decision Making in Game Theory	249
Section 8.3	Saddle Points	255
Section 8.4	Mixed Strategies	258
Section 8.5	The Fundamental Theorem	265
Section 8.6	Computational Techniques	274
Section 8.7	Games People Play	284
CHAPTER 9	OTHER TOPICS IN GAME THEORY	293
Section 9.1	Utility Theory	293
Section 9.2	Two-Person, Non-Zero-Sum Games	296
Section 9.3	Noncooperative Two-Person Games	299
Section 9.4	Cooperative Two-Person Games	305
Section 9.5	The Axioms of Nash	310
Section 9.6	An Example	316

APPENDIXES	319
Appendix A Vectors and Matrices	319
Appendix B Programming the Simplex Method	323
BIBLIOGRAPHY	327
INDEX	331