

CONTENTS

Preface	xi
1 Introduction	1
<i>1-1</i> The Beginning and Progress of Operations Research	1
<i>1-2</i> Classification of Problems in Operations Research	3
<i>1-3</i> Mathematical Modeling in Operations Research	5
Part One Deterministic Operations Research Models	
2 Dynamic Programming	11
<i>2-1</i> Introduction	11
<i>2-2</i> Investment Problem	12
<i>2-3</i> Dynamic Programming Solution of the General Allocation Problem	18
<i>2-4</i> Stagecoach Problem	27
<i>2-5</i> Production Scheduling	38
<i>2-6</i> Equipment Replacement	50
<i>2-7</i> Summary	63

3 Linear Programming	68
3-1 Introduction	68
3-2 Formulation of Linear Programming Models	69
3-3 Graphic Solution of Linear Programming Models	74
3-4 Maximization with Less-than-or-equal-to Constraints	78
3-5 Equalities and Greater-than-or-equal-to Constraints	86
3-6 Minimization of the Objective Function	88
3-7 The Simplex Method	90
3-8 Example to Illustrate Simplex Algorithm	95
3-9 Computer Program for Algorithm 3.1	100
3-10 Properties of the Simplex Method	106
3-11 Transportation Problem	107
3-12 Assignment Problem	110
4 Integer Programming	129
4-1 Introduction	129
4-2 Implicit Enumeration	130
4-3 Cutting-Plane Technique	164
5 Branch-and-Bound Technique	193
5-1 Introduction	193
5-2 Branch-and-Bound Algorithm for Assignment Problem	194
5-3 Branch-and-Bound Algorithms for Traveling Salesman Problem	202
5-4 Branch-and-Bound Algorithm for Integer Programming	211
5-5 Branch-and-Bound Algorithm for Backpack-loading Problem	217
5-6 Algorithm 5.4—General Algorithm for the Branch-and-Bound Technique	233
6 Deterministic Inventory Models	242
6-1 Introduction	242
6-2 Infinite Delivery Rate with No Backordering	244
6-3 Finite Delivery Rate with No Backordering	250
6-4 Infinite Delivery Rate with Backordering	253
6-5 Finite Delivery Rate with Backordering	257
6-6 Summary	259
7 Sequencing Problems	262
7-1 Introduction	262
7-2 Two-Machine Sequencing Problem	263
7-3 <i>N</i> -Job, Three-Machine Sequencing Problem	278
Part Two Probabilistic Operations Research Models	
8 Basic Probability and Statistical Concepts	293
8-1 Introduction	293

8-2	Basic Probability	293
8-3	Random Variables	299
8-4	Discrete Random Variables	300
8-5	Continuous Random Variables	308
8-6	Selecting the Appropriate Distribution	317
9	Regression Analysis	326
9-1	Introduction	326
9-2	Polynomial Regression	329
9-3	Simple Linear Regression	348
9-4	Summary	379
10	Decision Theory	383
10-1	Introduction	383
10-2	Minimax Decision Procedure	385
10-3	Bayes Decision Procedure without Data	386
10-4	Bayes Decision Procedure with Data	388
10-5	Regret Function vs. Loss Function	398
11	Game Theory	402
11-1	Introduction	402
11-2	Minimax-Maximin Pure Strategies	403
11-3	Mixed Strategies and Expected Payoff	406
11-4	Solution of 2×2 Games	409
11-5	Relevant Rows and Columns	411
11-6	Dominance	412
11-7	Solution of $2 \times n$ Games	415
11-8	Solution of $m \times 2$ Games	423
11-9	Brown's Algorithm	425
12	PERT	434
12-1	Introduction	434
12-2	PERT Network	435
12-3	Time Estimates for Activities (ET)	437
12-4	Earliest Expected Completion Time of Events (TE)	439
12-5	Latest Allowable Event Completion Time (TL)	440
12-6	Event Slack Times (SE)	442
12-7	Critical Path	442
12-8	Probability of Completing Events on Schedule	443
12-9	Computer Program for PERT Analysis	446
13	Queueing Theory	454
13-1	Introduction	454
13-2	Notation and Assumptions	455
13-3	Queueing Models with Poisson Input-Exponential Service	459

13-4	Queueing Models with Poisson Input—Arbitrary Service Time	486
13-5	Summary	494
14	Simulation	497
14-1	Introduction	497
14-2	Simulation of a Single-Queue, Single-Server Queueing System	499
14-3	Generation of Random Variates	516
14-4	Simulation Languages	523
15	Probabilistic Inventory Models	528
15-1	Introduction	528
15-2	Single-Period Models	529
15-3	Multiperiod Models	544
15-4	Summary	561
16	Markov Chains	564
16-1	Introduction	564
16-2	Formulation of Markov Chains	565
16-3	First-Passage Time	580
16-4	Computer Program for Markov Analysis	584
16-5	Summary	590
	Appendixes	593
<i>Appendix A</i>	Tables	593
<i>Table A.1</i>	Cumulative Normal Distribution Function	593
<i>Table A.2</i>	Critical Values for Chi-Square Test	594
<i>Table A.3</i>	Critical Values of D in the Kolmogorov-Smirnov One-Sample Test	595
<i>Table A.4</i>	Critical Values for F Test with $\alpha = 0.05$	596
<i>Table A.5</i>	Critical Values for F Test with $\alpha = 0.01$	597
<i>Appendix B</i>	Derivation of Queueing Formulas	598
<i>Appendix C</i>	Gauss-Jordan Method for Solving a System of Linear Equations	603
	Index	607