

Contents

Acknowledgments	v
1 Introduction	1
1.1 Theme and Methodologies	2
1.2 Relations to Other Approaches	2
1.3 Organization and Overview	4
2 Stochastic Monotonicity, Convexity, and Submodularity	5
2.1 Stochastic and Likelihood-Ratio Orderings	5
2.2 Stochastic Convexity	7
2.3 Stochastic Submodularity	11
2.4 Markov Chain Applications	14
2.5 Notes	16
3 Quality Control for Products with Warranty	19
3.1 Warranty Cost Functions	20
3.2 K -Submodularity	23
3.3 Conditional Distribution for Defectives	26
3.4 Optimal Policy	27
3.5 The Individual Warranty Model	31
3.6 Examples and Extensions	34
3.7 Notes	35

4	Process Control in Batch Production	37
4.1	Machine Revision	38
4.2	MDP Formulation	42
4.2.1	MDP Essentials	42
4.2.2	The MDP Problem	44
4.3	Discounted-Cost Model	45
4.3.1	Optimality Equations	45
4.3.2	Structural Properties	47
4.3.3	Optimal Policies	51
4.4	Average-Cost Model	56
4.5	A Special Case: No Inspection Cost	57
4.6	Notes	62
5	Coordinated Production-Inspection in a Tandem System	65
5.1	A Two-Stage Tandem Queue	66
5.1.1	Problem Statement	66
5.1.2	The SMDP Formulation	67
5.2	Stationary Optimal Policies	72
5.3	Structure of the Optimal Policy	79
5.4	Notes	86
6	Sequential Inspection Under Capacity Constraints	89
6.1	Capacity Constraints	90
6.2	Optimality of the Threshold Policy	93
6.3	Further Characterization of the Optimal Policy	100
6.4	An Application in Semiconductor Manufacturing	104
6.5	Notes	106
7	Coordination of Interstage Inspections	109
7.1	Two-Stage Quality Control	110
7.2	Analysis of Stage 1	112
7.3	Optimal Policy at Stage 2	116
7.3.1	Priority Structure	116
7.3.2	Threshold Structure	120
7.4	A Special Case: Constant Defective Rates	125
7.5	Optimal Policy at Stage 1	127
7.6	General Cost Functions	132
7.7	Notes	136
8	Optimal Inspection in an Assembly System	139
8.1	A Two-Component Assembly Model	140
8.2	Dynamic Programming Formulation	143
8.3	One Component with a Constant Defective Rate	145
8.4	A Heuristic Policy	154
8.5	Notes	156

9 Coordinated Replenishment and Rework with Unreliable Supply Sources	159
9.1 The Inspection/Rework Model	160
9.2 Properties of the Cost Function	162
9.3 Optimal Solution to the Inspection Problem	166
9.4 Optimal Replenishment Quantities	171
9.5 Optimal Replenishment over an Infinite Horizon	177
9.6 A Random Yield Model with Multiple Sources	184
9.7 Notes	187
10 Inventory Control with Substitution	189
10.1 Model Description	189
10.2 The Optimal Substitution Policy	191
10.3 Formulation of the Replenishment Decision	194
10.4 Concavity and Submodularity	197
10.5 The Optimal Order Quantities	200
10.6 Upper and Lower Bounds	202
10.7 Notes	204
References	207
Index	216