

Contents

1	Introduction	1
1.1	Importance of Capital Goods, Maintenance and Spare Parts	1
1.2	Trends	3
1.3	Typical Features of Spare Parts Inventories	5
1.4	Objectives of This Book	7
1.5	Outline	8
	References	9
2	Basic Multi-Item, Single-Location Inventory Model	11
2.1	Introduction	11
2.2	Basic Model	12
2.2.1	Overview of Assumptions	14
2.3	Evaluation	15
2.4	Optimization	18
2.4.1	Convexity of the Mean Backorder Positions	19
2.4.2	Greedy Algorithm	20
2.5	Alternative Optimization Techniques	23
2.5.1	Lagrangian Relaxation	24
2.5.2	Dantzig-Wolfe Decomposition	26
2.6	Item Approach	29
2.7	Alternative Service Measures	30
2.7.1	Aggregate Mean Waiting Time	30
2.7.2	Average Availability	31
2.7.3	Sum of Backorder Probabilities	32
2.7.4	Aggregate Fill Rate	34
2.7.5	Aggregate Mean Number of Stockouts	36
2.8	Inventory Planning During the Exploitation Phase	38
2.9	Emergency Shipments	39
2.10	Extensions	42
2.10.1	Consumables and Condemnation	42
2.10.2	Excluding Pipeline Stock	42

2.10.3	Batching	43
2.10.4	Criticality	44
2.11	Concluding Remarks	45
	Problems	45
	References	48
3	Multiple Machine Types with Commonality	51
3.1	Introduction	51
3.2	Model	52
3.3	Analysis	55
3.3.1	Enumeration	55
3.3.2	Greedy Heuristic	56
3.3.3	Dantzig-Wolfe Decomposition	58
3.4	Computational Results	62
3.4.1	Setup for Experiment 1	62
3.4.2	Quality of the Heuristics	64
3.4.3	Benefits of Commonality	66
3.5	Case Study: ASML	67
3.6	Concluding Remarks	68
	Problems	69
	References	70
4	Service Differentiation	71
4.1	Introduction	71
4.2	Model	72
4.3	Underlying Single Item Problem	75
4.3.1	Single Item Model	75
4.3.2	Exact Solution for Problem (Q(S))	77
4.3.3	Exact Solution for Problem (Q)	79
4.4	Dantzig-Wolfe Decomposition	81
4.4.1	Lower Bound	81
4.4.2	Heuristic Solution	83
4.5	Computational Experiment	84
4.6	Case Study: ASML	89
4.7	Concluding Remarks	91
	Problems	92
	References	94
5	Multi-location System with Lateral Transshipments	97
5.1	Introduction	97
5.2	Model	98
5.3	Exact Evaluation	103
5.4	Approximate Evaluation	105
5.4.1	Decoupling the Regulars from the Mains	106
5.4.2	Decoupling the Mains	107

5.4.3	Formal Description of the Approximate Evaluation Method .	109
5.4.4	Numerical Comparison	110
5.5	Greedy Heuristic	114
5.6	Partial vs. Full Pooling	117
5.7	Case Study: ASML	118
5.8	Concluding Remarks	121
	Problems	122
	References	124
6	Two-Echelon System	127
6.1	Introduction	127
6.2	Model	128
6.3	Evaluation Procedures	131
6.3.1	Exact Evaluation	131
6.3.2	Approximate Evaluation Based on Two-Moment Fits	135
6.3.3	METRIC Approach	138
6.4	Heuristics	139
6.4.1	Greedy Heuristic	139
6.4.2	Local Search	141
6.4.3	Dantzig-Wolfe Decomposition	142
6.4.4	Overview of Heuristics	143
6.5	Computational Results	144
6.5.1	Setup of Test Beds	144
6.5.2	Quality of the Heuristics	145
6.5.3	Applying Approximate Evaluation Methods	148
6.6	Concluding Remarks	150
	Appendix: Fitting Discrete Distributions on the First Two Moments	151
	Problems	155
	References	157
7	Multi-echelon, Multi-indenture System	159
7.1	Introduction	159
7.2	Model	160
7.2.1	Overview of Assumptions and Notations	165
7.3	Exact Evaluation	167
7.3.1	Preliminary Results	168
7.3.2	Recursive Expressions for Pipelines	169
7.4	Approximate Evaluation	172
7.5	Greedy Heuristic	174
7.6	Case: Royal Netherlands Navy	176
7.6.1	Optimizing Inventory Investment and System Availability	176
7.6.2	Case Results	178
7.7	Concluding Remarks	180
	Problems	181
	References	182

8	Static Repair Priorities	185
8.1	Introduction	185
8.2	Model	187
8.3	Evaluation	190
8.4	Optimization	192
	8.4.1 Optimization of the Basestock Policy	193
	8.4.2 Optimization of the Priority Assignment	194
8.5	Computational Results	196
	8.5.1 Test Bed	196
	8.5.2 Optimality Gap of the Heuristics	197
	8.5.3 Comparison of the Heuristics for Large Instances	200
	8.5.4 Costs Savings Relative to FCFS	201
8.6	Stylized Cases	203
8.7	Concluding Remarks	204
	Problems	206
	References	207
	Answers to Selected Problems	209
	Index	211

Spare Parts Inventory Control under System Availability
Constraints

van Houtum, G.-J.; Kranenburg, B.

2015, XV, 215 p. 23 illus., 7 illus. in color., Hardcover

ISBN: 978-1-4899-7608-6