

Thomas Hanne • Rolf Dornberger

Computational Intelligence in Logistics and Supply Chain Management

 Springer

Contents

1	Introduction to Logistics and Supply Chain Management	1
1.1	The Concept of Logistics and Supply Chain Management	1
1.2	A Short History of Logistics	4
1.3	Recent Trends and the Modern Importance of Logistics	5
1.4	The Need for a Better Planning	10
	References	12
2	Computational Intelligence	13
2.1	Foundations of Computational Intelligence	14
2.1.1	Artificial and Computational Intelligence and Related Techniques	14
2.1.2	Properties of Computational Intelligence	17
2.1.3	The Big Picture of Computational Intelligence	18
2.1.4	Application Areas of Computational Intelligence	20
2.2	Methods of Computational Intelligence	22
2.2.1	Evolutionary Computation	22
2.2.2	Evolutionary Algorithms	23
2.2.3	Swarm Intelligence	32
2.2.4	Neural Networks	35
2.2.5	Fuzzy Logic	36
2.2.6	Artificial Immune System	36
2.2.7	Further Related Methods	36
	References	39
3	Transportation Problems	43
3.1	Assignment Problems	44
3.2	Shortest Paths	45
3.3	The Travelling Salesman Problem	47

3.4	Methods for Solving the Travelling Salesman Problem	50
3.4.1	Heuristics for the Travelling Salesman Problem	50
3.4.2	Evolutionary Algorithms for the Travelling Salesman Problem	51
3.4.3	Other Metaheuristics and Neural Networks for the Travelling Salesman Problem	55
3.4.4	On the Performance of Solution Approaches	56
3.5	The Vehicle Routing Problem	57
3.5.1	The Vehicle Routing Problem with Time Windows	59
3.5.2	The Vehicle Routing Problem with Multiple Vehicles	59
3.5.3	The Vehicle Routing Problem with Multiple Depots	60
3.5.4	More Differentiated Problem Variants	61
3.6	Solution Approaches for Vehicle Routing Problems	62
3.7	The Pickup and Delivery Problem	65
3.8	Network Flow Problems	67
	References	68
4	Inventory Planning and Lot-Sizing	73
4.1	The Need for Inventory Planning	73
4.2	Economic Order Quantities and Safety Stocks	75
4.3	Capacitated Lot-Sizing Problems	79
4.4	Solution Approaches for Capacitated Lot-Sizing Problems	83
4.5	Planning Warehouse Operations	85
4.6	Storage Locations	87
4.7	Inventory Routing	88
	References	94
5	Scheduling	99
5.1	Introduction	99
5.2	Simple Rules and Heuristics	100
5.3	Standard Scheduling Problems	103
5.3.1	Job Shop Scheduling	105
5.3.2	Flow Shop Scheduling	106
5.3.3	Open Shop Scheduling	107
5.4	Specific Scheduling Problems in Logistics	108
5.5	Solving Scheduling Problems with Computational Intelligence Techniques	110
5.5.1	Encoding Issues	110
5.5.2	Usage of Metaheuristics in Scheduling	115
	References	117

- 6 Location Planning and Network Design** 121
 - 6.1 Location Planning as Multicriteria Decision Problems 121
 - 6.2 Discrete Location Problems 123
 - 6.2.1 The p-Median Problem 124
 - 6.2.2 The p-Center Problem 128
 - 6.2.3 The Uncapacitated Facility Location Problem (UFLP) 130
 - 6.2.4 The Capacitated Facility Location Problem (CFLP) 133
 - 6.3 Continuous Location Problems 135
 - 6.3.1 The Uncapacitated Multi-facility Weber Problem (UMWP) 135
 - 6.3.2 The Capacitated Multi-facility Weber Problem (CMWP) 138
 - 6.4 Location Routing Problems 141
 - 6.5 Hub Location Problems 144
 - 6.6 Multi-Echelon Network Design 145
 - 6.7 Conclusions 146
 - References 146
- 7 Intelligent Software for Logistics** 153
 - 7.1 General-Purpose Optimization Software 153
 - 7.1.1 Setting Up a Suitable Model for the Optimization Software 155
 - 7.1.2 Integration of Optimization Software with Logistics Applications 156
 - 7.1.3 Adapting the Method to the Problem Under Consideration 157
 - 7.2 Software Providing Specific Optimization Algorithms or Supporting Particular Optimization Problems 157
 - 7.3 General-Purpose Business Software 160
 - 7.4 Logistics Software 163
 - 7.4.1 Warehouse Management Systems 163
 - 7.4.2 Software for Transportation Planning 165
 - 7.4.3 Packing and Loading Software 166
 - 7.5 Conclusions 167
 - References 168
- Authors Brief Biographies** 171
- Index** 173