

# Contents

<b>Preface</b>	v
<b>Acknowledgement</b>	ix
<b>Chapter 1</b> Introduction	1
1.1 Brief History of AI	1
1.2 Cognitive Issues of AI	5
1.3 Hierarchical Model of Thought	7
1.4 Symbolic Intelligence	9
1.5 Research Approaches of Artificial Intelligence	12
1.6 Automated Reasoning	15
1.7 Machine Learning	18
1.8 Distributed Artificial Intelligence	20
1.9 Artificial Thought Model	24
1.10 Knowledge Based Systems	25
Exercises	29
<b>Chapter 2</b> Logic Foundation of Artificial Intelligence	30
2.1 Introduction	30
2.2 Logic Programming	33
2.3 Nonmonotonic Logic	45
2.4 Closed World Assumption	47
2.5 Default Logic	50
2.6 Circumscription Logic	56
2.7 Nonmonotonic Logic NML	60
2.8 Autoepistemic Logic	63

2.9 Truth Maintenance System	72
2.10 Situation Calculus	78
2.11 Frame Problem	82
2.12 Dynamic Description Logic	95
Exercises	105
<b>Chapter 3 Constraint Reasoning</b>	107
3.1 Introduction	107
3.2 Backtracking	114
3.3 Constraint Propagation	116
3.4 Constraint Propagation in Tree Search	119
3.5 Intelligent Backtracking and Truth Maintenance	119
3.6 Variable Instantiation Ordering and Assignment Ordering	121
3.7 Local Revision Search	122
3.8 Graph-based Backjumping	122
3.9 Influence-based Backjumping	124
3.10 Constraint Relation Processing	129
3.11 Constraint Reasoning System COPS	134
3.12 ILOG Solver	139
Exercise	146
<b>Chapter 4 Qualitative Reasoning</b>	147
4.1 Introduction	147
4.2 Basic approaches in qualitative reasoning	148
4.3 Qualitative Model	150
4.4 Qualitative Process	153
4.5 Qualitative Simulation Reasoning	157
4.6 Algebra Approach	161
4.7 Spatial Geometric Qualitative Reasoning	163
Exercises	170
<b>Chapter 5 Case-Based Reasoning</b>	171
5.1 Overview	171
5.2 Basic Notations	173
5.3 Process Model	175

5.4 Case Representation	179
5.5 Case Indexing	184
5.6 Case Retrieval	185
5.7 Similarity Relations in CBR	188
5.8 Case Reuse	194
5.9 Case Retainion	196
5.10 Instance-Based Learning	197
5.11 Forecast System for Central Fishing Ground	203
Exercises	213
<b>Chapter 6 Probabilistic Reasoning</b>	214
6.1 Introduction	214
6.2 Foundation of Bayesian Probability	219
6.3 Bayesian Problem Solving	225
6.4 Naïve Bayesian Learning Model	234
6.5 Construction of Bayesian Network	241
6.6 Bayesian Latent Semantic Model	249
6.7 Semi-supervised Text Mining Algorithms	253
Exercises	259
<b>Chapter 7 Inductive Learning</b>	260
7.1 Introduction	260
7.2 Logic Foundation of Inductive Learning	262
7.3 Inductive Bias	270
7.4 Version Space	272
7.5 AQ Algorithm for Inductive Learning	278
7.6 Constructing Decision Trees	279
7.7 ID3 Learning Algorithm	280
7.8 Bias Shift Based Decision Tree Algorithm	287
7.9 Computational Theories of Inductive Learning	302
Exercises	307
<b>Chapter 8 Support Vector Machine</b>	309
8.1 Statistical Learning Problem	309
8.2 Consistency of Learning Processes	311

8.3 Structural Risk Minimization Inductive Principle	314
8.4 Support Vector Machine	317
8.5 Kernel Function	323
Exercises	326
<b>Chapter 9</b> Explanation-Based Learning	328
9.1 Introduction	328
9.2 Model for EBL	329
9.3 Explanation-Based Generalization	331
9.4 Explanation Generalization using Global Substitutions	337
9.5 Explanation-Based Specialization	340
9.6 Logic Program of Explanation-Based Generalization	344
9.7 SOAR Based on Memory Chunks	348
9.8 Operationalization	351
9.9 EBL with imperfect domain theory	356
Exercises	361
<b>Chapter 10</b> Reinforcement Learning	362
10.1 Introduction	362
10.2 Reinforcement Learning Model	365
10.3 Dynamic Programming	369
10.4 Monte Carlo Methods	370
10.5 Temporal-Difference Learning	373
10.6 Q-Learning	378
10.7 Function Approximation	381
10.8 Reinforcement Learning Applications	383
Exercises	386
<b>Chapter 11</b> Rough Set	387
11.1 Introduction	387
11.2 Reduction of Knowledge	393
11.3 Decision Logic	397
11.4 Reduction of Decision Tables	405
11.5 Extended Model of Rough Sets	419
11.6 Experimental Systems of Rough Sets	423

11.7 Granular Computing	425
11.8 Future Trends of Rough Set Theory	427
Exercises	429
<b>Chapter 12 Association Rules</b>	<b>430</b>
12.1 Introduction	430
12.2 The Apriori Algorithm	434
12.3 FP-Growth Algorithm	437
12.4 CFP-Tree Algorithm	441
12.5 Mining General Fuzzy Association Rules	444
12.6 Distributed Mining Algorithm For Association Rules	448
12.7 Parallel Mining of Association Rules	458
Exercises	465
<b>Chapter 13 Evolutionary Computation</b>	<b>467</b>
13.1 Introduction	467
13.2 Formal Model of Evolution System Theory	469
13.3 Darwin's Evolutionary Algorithm	472
13.4 Classifier System	473
13.5 Bucket Brigade Algorithm	479
13.6 Genetic Algorithm	480
13.7 Parallel Genetic Algorithm	488
13.8 Classifier System Boole	489
13.9 Rule Discovery System	493
13.10 Evolutionary Strategy	497
13.11 Evolutionary Programming	497
Exercises	498
<b>Chapter 14 Distributed Intelligence</b>	<b>499</b>
14.1 Introduction	499
14.2 The Essence of Agent	502
14.3 Agent Architecture	505
14.4 Agent Communication Language ACL	514
14.5 Coordination and Cooperation	524
14.6 Mobile Agent	543

14.7 Multi-Agent Environment MAGE	546
14.8 Agent Grid Intelligence Platform	550
Exercises	551
<b>Chapter 15 Artificial Life</b>	<b>553</b>
15.1 Introduction	553
15.2 Exploration of Artificial Life	559
15.3 Artificial Life Model	560
15.4 Research Approach of Artificial Life	564
15.5 Cellular Automata	568
15.6 Morphogenesis Theory	571
15.7 Chaos Theories	574
15.8 Experimental Systems of Artificial Life	575
Exercises	582
<b>References</b>	<b>585</b>