# Python

	Core Python Programming
	Part-01: Core Python
	Welcome to Python
01	What is Python?
02	Origins
08	Features – Topics 6
09	Downloading and Installing Python
14	Running Python – Topics 5
15	Python Documentation
16	Comparing Python
17	Other Implementations
18	Exercise
	Getting Started
19	Program Output, the Print Statement, and "Hello World"
20	Program Input and the Raw input() Built-in Function
21	Comments
22	Operators
23	Variables and Assignment
24	Numbers
25	Strings
26 27	Lists and Tuples Dictionaries
28	Code Blocks Use Indentation  (if) Statement
30	(whie) Loop
31	(for) loop and the range() Builtiin Function
32	List Comprehensions
33	Files and the open() and file() Built-in Functions
34	Errors and Expression
35	Functions
36	Class
37	Modules
38	Useful Functions
39	Exercises
	Python Basics
43	Statements and Syntax – Topics 4
44	Variable Assignment
45	Identifiers
48	Basic Style Guidelines – Topics 3
52	Memory Management – Topics 4
55	First Python Programs – Topics 3
56	Related Modules/Developer Tools
57	Exercises
	Python Objects
58	Python Objects
59	Standard Types
60	Internal Types

65	Standard Type Operators – Topics 5
70	Standard Type Built-in Functions – Topics 5
71	Type Factory Functions
73	Categorizing the Standard Types – Topics 2
74	Unsupported Types
75	Exercise
7.5	Numbers
76	Introducing to Numbers
77	Integers
78	Double Precision Floating Point Numbers
79	Complex Numbers
83	Operators – Topics 4
87	Built-in and Factory Functions – Topics 4
88	Other Numeric Types
89	Related Modules
90	Exercises
30	Sequences: Strings, Lists, and Tuples
94	Sequences – Topics 4
95	Strings
97	Strings and Operators – Topics 2
100	String-Only Operators – Topics 3
103	Built-in Functions – Topics 3
106	String Built-in Methods – Topics 3
109	Special Features of Strings – Topics 3
113	Unicode – Topics 4
114	Related Modules
115	Summary of String Highlights
116	Lists
118	Operators – Topics 2
119	Built-in Functions
120	List Type Built-in Methods
121	Special Features of Lists
122	Tuples
123	Tuple Operators and Built-in Functions
125	Special Features of Tuples – Topics 2
126	Related Modules
127	Copying Python Objects and Shallow and Deep Copies
128	Summary of Sequences
129	Exercises
	Mapping and Set Types
133	Mapping Type: Dictionaries – Topics 4
134	Mapping Type Operators
137	Mapping Type Built-in and Factory Functions – Topics 3
138	Mapping Type Built-in Methods
139	Dictionary Keys
140	Set Types
142	Set Type Operators – Topics 2
143	Built-in Function
144	Set Type Built-in Methods
145	Operator, Function/Method Summary Table for Set Types
146	Related Modules

147	Exercises
	Conditionals and Loops
148	(if) Statement
149	(else) Statement
150	(elseif) Statement
151	Conditional Expressions (aka "the Temary Operator")
152	(while) Statement
156	(for) Statement – Topics 4
157	(break) Statement
158	(continue) Statement
159	(pass) Statement
160	(else) Statement Take Two
164	Iterators and the iter() Function – Topics 4
166	List Comprehensions – Topics 2
169	Generator Expression – Topics 3
170	Related Modules
171	Exercises
	Files and Input / Output
172	File Objects
174	File Built-in Functions [open() and file()] – Topics 2
178	File Built-in Methods – Topics 4
179	File Built-in Attributes
180	Standard Files
181	Command-Line Arguments
185	File System – Topics 4
186	File Execution
187	Persistent Storage Modules
188	Related Modules
189	Exercises
	Error and Exception
190	What are Exceptions?
191	Exceptions in Python
202	Detecting and Handling Exceptions – Topics 11
204	Context Management – Topics 2
205	Exceptions as Strings
207	Raising Exceptions – Topics 2
208	Assertions
211	Standard Exceptions – Topics 3
214	Creating Exceptions – Topics 3
215	Why Exceptions(Now)
216	Why Exceptions at All
217	Exceptions and the sys Module
218	Related Modules
219	Exercises
	Functions and Functional Programming
221	What are Functions? – Topics 2
225	Calling Functions – Topics 4
233	Creating Functions – Topics 8
234	Passing Functions
237	Formal Arguments – Topics 3
242	Variable-Length Arguments – Topics 5
	Tallada Tallada Tallada Tallada

250	Functional Programming Tanics 0
260	Functional Programming – Topics 8
261	Variable Scope – Topics 10  Recursion
263	Generator – Topics 2
264	Exercises
265	Modules  What are Madules?
265	What are Modules?
267	Modules and Files – Topics 2
270	Namespaces – Topics 3
272	Importing Modules – Topics 2
276	Features of Module Import – Topics 4
278	Module Built-in Functions – Topics 2
281	Packages – Topics 3
284	Other Features of Modules – Topics 3
285	Related Modules
286	Exercises
287	Object-Oriented Programming
292	Introduction – Topics 5
295	Object-Oriented Programming – Topics 3
296	Classes
200	Class Attributes – Topics 4
203	Instances – Topics 3
207	Instance Attributes – Topics 4
208	Binding and Method Invocation
209	Static Methods and Class Methods
210	Composition
211	Sub-classing and Derivation
216	Inheritance – Topics 5
218	Built-in Functions for Classes, Instances, and Other Objects – Topics 2
226	Customizing Classes with Special Methods – Topics 8
227	Privacy
231	Delegation – Topics 4
239	Advanced Features of New-Style Classes (Python 2.2+) – Topics 8
240	Related Modules and Documentation
242	Exercises
	Execution Environment
245	Callable Objects – Topics 3
246	Code Objects
252	Executable Object Statements and Built-in Functions – Topics 6
254	Executing Other (Python) Programs – Topics 2
258	Executing Other (Non-Python) Programs – Topics 4
259	Restricted Execution
261	Terminating Execution – Topics 2
262	Miscellaneous Operating System Interface
263	Related Modules
264	Exercise
	Part-02: Advanced Topics
	Regular Expression
268	Introduction / Motivation – Topics 2
272	Special Symbols and Characters – Topics 4
280	Res and Python – Topics 8
200	nes and Fysion Topics o

284	Regular Expressions Example – Topics 4
289	Exercises
	Network Programming
291	Introduction – Topics 2
292	Sockets: Communication End points
302	Network Programing in Python – Topics 10
304	SocketServer Module – Topics 2
304	Introduction to the Twisted Framework – Topics 2
305	Related Modules
306	Exercises
	Internet Client Programming
307	What Are Internet Clients?
311	Transferring Files – Topics 4
315	Network News – Topics 4
320	Electronic Mail – Topics 5
321	Related Modules
322	Exercises
	Multithreaded Programming
323	Introduction / Motivation
324	Threads and Processes
326	Python, Threads, and the Global Interpreter Lock – Topics 2
328	(thread) Module – Topics 2
334	(threading) Module – Topics 6
335	Related Modules
336	Exercise
	GUI Programming
338	Introduction – Topics 2
340	Tkinter Examples – Topics 2
346	Brief Tour of Other GUIs – Topics 6
350	Related Modules and Other GUIs – Topics 4
351	Exercises
	Web Programming
353	Introduction – Topics 2
359	Web Surfing with Python: Creating Simple Web Clients – Topics 6
360	Advanced Web Clients
361	CGI: Helping Web Severs Process Client Data
368	Building CGI Applications – Topics 7
369	Using Unicode with CGI
373	Advanced CGI – Topics 4
374	Web (HTTP) Servers
375	Related Modules
356	Exercise
	Database Programming
358	Introduction – Topics 2
366	Python Database Application Programmer's Interface (DB-API) – Topics 8
370	Object-Relational Managers (ORMs) – Topics 4
371	Related Modules
372	Exercise
	Extending Python
374	Introduction / Motivation – Topics 2
382	Extending Python by Writing Extensions – Topics 8

383	Related Topics
384	Exercise
	Miscellaneous
390	Web Services – Topics 2
396	Programming Microsoft Office with Win32 COM – Topics 6
397	Python and Java Programming with Jython
398	Exercises
	Python Cookbook: Recipes for Mastering Python 3

# Combinatorial Optimization

	Combinatorial Outimization
	Combinatorial Optimization Introduction
01	
01	Enumeration
02	Running Time of Algorithms
03	Linear Optimization Problems
04	Sorting
05	Exercises
	References
	Graphs
06	Basic Definitions
07	Trees, Circuits, and Cuts
08	Connectivity
09	Eulerian and Bipartite Graphs
10	Planarity
11	Planar Duality
12	Exercises
	References
	Linear Programming
13	Polyhedra
14	The Simplex Algorithm
15	Duality
16	Convex Hulls and Polytopes
17	Exercises
	References
	Linear Programming Algorithms
18	Size of Vertices and Faces
19	Continued Fractions
20	Gaussian Elimination
21	The Ellipsoid Method
22	Khachiyan's Theorem
23	Separation and Optimization
24	Exercises
	Integer Programming
25	The Integer Hull of a Polyhedron
26	Unimodular Transformations
27	Total Dual Integrality
28	Totally Unimodular Matrices
29	Cutting Planes
30	Lagrangean Relaxation
31	Exercises
32	Refernces
	Spanning Trees and Arborescences
33	Minimum Spoanning Trees
34	Minimum Weight Arborescences
35	Polyhedral Descriptions
36	Packing Spanning Trees and Arborescences
37	Exercises
38	References
30	I/CIEI CII/CE2

	Shortest Paths
39	Shortest Paths Shortest Paths Form One Source
	Shortest Paths Form One Source Shortest Paths Between All Pairs of Vertices
40	
41	Minimum Mean Cycles
42	Exercises
	Refernces
40	Network Flows
43	Max-Flow-Min-Cut Theorem
44	Mengers Theorem
45	The Edmonds-Karp algorithm
46	Blocking Flows
47	The Goldberg-Tarjan Algorithm
48	Gomory-Hu Trees
49	The Minimum Cut in an Undirected Graph
50	Exercises
	References
	Minimum Cost Flows
51	Problem Formulation
52	An Optimality Criterion
53	Minimum Mean Cycle-Cancelling Algorithm
54	Successive Shortest Path Algorithm
55	Orlin's Algorithm
56	Exercises
	References
	Maximum Matchings
57	Bipartite Matching
58	The Tuttel Matrix
59	Tutte's Theorem
60	Ear-Decompositions of Factor-Critical Graphs
61	Edmonds' Matching Algorithm
62	Exercises
	References
	Weighted Matching
63	The Assignment Problem
64	Outline of the Weighted Matching Algorithm
65	Implementation of the Weighted Matching Algorithm
66	Postoptimality
67	The Matching Polytope
68	Exercises
	References
	b-Matchings and T-Joins
69	b-Matchings
70	Minimum Weight T-Joins
71	T-Joins and T-Cuts
72	The Padberg-Rao Theorem
73	Exercises
	References
	Matroids
74	Independence Systems and Matroids
75	Other Matroid Axioms
76	Duality

77	The Greedy Algorithm
78	Matroid Intersection
79	Matroid Intersection  Matroid Partitioning
80	Weighted Matroid Intersection
81	Exercises
01	Refernces
	Generalizations of Matroids
82	Greedoids
83	Polymartoids
84	Minimizing Submodular Functions
85	Exercises
83	References
	NP-Completeness
86	Turing Machines
87	Church's Thesis
88	P and NP
89	Cook's Theorem
90	Some Basic NP-Complete Problems
91	The Class coNp
92	NP-Hard Problems
93	Exercises
<i>J J</i>	References
	Approximation Algorithms
94	Set Converting
95	Colouring
96	Approximation Schemes
97	Maximum Satisfiability
98	The PCP Theorem
99	L-Reductions
100	Exercises
100	Refernces
	The Knapsack Problem
101	Fractional Knapsack and Weighted Median Problem
102	A Pseudopolynomial Algorithm
103	A Full Polynomial Approximation Scheme
104	Exercises
	References
	Bin-Packing
105	Greedy Heuristics
106	An Asymptotic Approximation Scheme
107	The Karmarkar-Karp Algorithm
108	Exercises
	References
	Multicommodity Flows and Edge-Disjoint Paths
109	Multicommodty Flows
110	Algorithms for Multicommodity Flows
111	Directed Edge-Disjoint Paths Problem
112	Undirected Edge-Disjoint Paths Problem
113	Exercises
	References
	Network Design Problems

114	Steiner Trees
115	Survivable Network Design
116	A Primal-Dual Approximation Algorithm
117	Jain's Algorithm
118	Exercises
	References
	The Traveling Salesman Problem
119	Approximation Algorithms for the TSP
120	Euclidean TSPs
121	Local Search
122	The Traveling Salesman Polytope
123	Lower Bounds
124	Branch-and-Bound
125	Exercises
	References

# Artificial Intelligence

	Autificial Intelligence: A Modern Annuacch
	Artificial Intelligence: A Modern Approach
	Part-01: Artificial Intelligence Introduction
05	
05	What is AI? – Topics 5
17	The Foundations of Artificial Intelligence – Topics 12
29	The History of Artificial Intelligence – Topics 12
30	The State of the Art
	Summary, Bibliographical and Historical Notes, Exercises
24	Intelligent Agents
31	Agents and Environments
34	Good Behavior: The Concept of Rationality – Topics 3
38	The Name Nature of Environments – Topics 4
45	The Structure of Agents – Topics 7
	Summary, Bibliographical and Historical Notes, Exercises
	Problem-Solving
	Solving Problems by Searching
49	Problem-Solving Agents – Topics 4
52	Example Problems – Topics 3
56	Searching for Solutions – Topics 4
64	Uninformed Search Strategies – Topics 8
72	Informed (Heuristic) Search Strategies – Topics 8
77	Heuristic Functions – Topics 5
	Summary, Bibliographical and Historical Notes, Exercises
	Beyond Classical Search
84	Local Search Algorithms and Optimization Problems – Topics 7
87	Local Search in Continuous Spaces – Topics 3
90	Searching with Nondeterministic Actions – Topics 3
96	Searching with Partial Observations – Topics 6
100	Online Search Agents and Unknown Environments – Topics 4
	Summary, Bibliographical and Historical Notes, Exercises
	Adversarial Search
102	Games – Topics 2
105	Optimal Decisions in Games – Topics 3
108	Alpha-Beta Pruning – Topics 3
112	Imperfect Real-Time Decisions – Topics 4
114	Stochastic Games – Topics 2
117	Partially Observable Games – Topics 3
119	Stage-of-the-Art Game Programs – Topics 2
120	Alternative Approaches
	Summary, Bibliographical and Historical Notes, Exercises
	Constraint Satisfaction Problems
125	Defining Constraint Satisfaction Problems – Topics 5
131	Constraint Propagation: Inference in CSPs – Topics 6
135	Backtracking Search for CSPs – Topics 4
136	Local Search for CSPs
138	The Structure of Problems – Topics 2
	Summary, Bibliographical and Historical Notes, Exercises
	Part-03: Knowledge, Reasoning, and Planning

	Logical Agents
139	Knowledge-Based Agents
141	The Wumpus Words – Topics 2
143	Logic – Topics 2
148	Propositional Logic: A Very Simple Logic – Topics 5
156	Propositional Theorem Proving – Topics 8
161	Effective Propositional Model Checking – Topics 5
167	Agents Based on Propositional Logic – Topics 6
_	Summary, Bibliographical and Historical Notes, Exercises
	First-Order Logic
171	Representation Revisited – Topics 4
181	Syntax and Semantics of First-Order Logic – Topics 10
186	Using First-Order Logic – Topics 5
190	Knowledge Engineering in First-Order Logic – Topics 4
	Summary, Bibliographical and Historical Notes, Exercises
	Inference in First-Order Logic
192	Propositional vs. First-Order Inference – Topics 2
196	Unification and Lifting – Topics 4
201	Forward Chaining – Topics 5
208	Backward Chaining – Topics 7
220	Resolutions – Topics 12
	Summary, Bibliographical and Historical Notes, Exercises
	Classical Planning
226	Definition of Classical planning – Topics 6
230	Algorithms for Planning as State-Space Search – Topics 4
235	Planning Graphs – Topics 5
239	Other Classical Planning Approaches – Topics 4
240	Analysis of Planning Approaches
	Summary, Bibliographical and Historical Notes, Exercises
	Planning and Acting in the Real World
244	Time, Schedules, and Resources – Topics 4
230	Hierarchical Planning – Topics 6
238	Planning and Acting in Nondeterministic Domains – Topics 8
242	Multiagent Planning – Topics 4
	Summary, Bibliographical and Historical Notes, Exercises
	Knowledge Representation
244	Ontological Engineering – Topics 2
248	Categories and Objects – Topics 4
252	Events – Topics 4
254	Mental Events and Mental Objects – Topics 2
257	Reasoning Systems for Categories – Topics 3
260	Reasoning with Default Information – Topics 3
263	The Internet Shopping World – Topics 3
	Summary, Bibliographical and Historical Notes, Exercises
	Part-04: Uncertain Knowledge and Reasoning
	Quantifying Uncertainty
269	Acting Under Uncertainty – Topics 3
273	Basic Probability Notation – Topics 4
275	Inference Using Full Joint Distributions – Topics 2
276	Independence
278	Bayes' Rule and Its Use – Topics 2

Summary, bibliographical and Historical Notes, Exercises  Probabilistic Reasoning  281 Representing Knowledge in an Uncertain Domain  282 The Semantics of Bayesian Networks — Topics 3  287 Efficient Representation of Conditional Distributions — Topics 3  284 Exact Inference in Bayesian Networks — Topics 7  302 Approximate Inference in Bayesian Networks — Topics 8  307 Relational and First-Order Probability Models — Topics 5  311 Other Approaches to Uncertain Reasoning — Topics 4  Summary, Bibliographical and Historical Notes, Exercises  Probabilistic Reasoning Over Time  314 Time and Uncertainty — Topics 3  315 Inference in temporal Models — Topics 5  327 Kalman Filters — Topics 5  328 Hidden Markow Models — Topics 3  339 Inference in temporal Models — Topics 5  330 Opnamic Bayesian Networks — Topics 7  336 Keeping Track of Mary Objects — Topics 7  337 Combining Beliefs and Desires Under Uncertainty  341 The Basis of Utility Theory — Topics 4  343 Utility Functions — Topics 5  349 Multiattribute Utility Functions — Topics 2  340 Multiattribute Utility Functions — Topics 3  351 Decision Networks — Topics 2  352 Summary, Bibliographical and Historical Notes, Exercises  353 Decision Froetic Expert Systems — Topics 2  354 Making Simple Decisions  355 The Value of Information — Topics 4  357 Decision— Theoretic Expert Systems — Topics 2  358 Summary, Bibliographical and Historical Notes, Exercises  360 Policy Iteration — Topics 4  361 Sequential Decision Problems — Topics 4  362 Value Iteration  363 Sequential Decision Problems — Topics 4  364 Summary, Bibliographical and Historical Notes, Exercises  365 Policy Iteration — Topics 4  366 Policy Iteration — Topics 4  377 Super Sequential Decision Problems — Topics 5  378 Mechanism Design — Topics 5  379 Forms of Learning  380 Supervised Learning  381 Learning Form Examples  382 Further of Calman Problems — Topics 5  383 Mechanism Design — Topics 2  384 Supervised Learning  385 The Theory of Learning — Topics 3  386 Learning Decision Problems — Topics 5  387 Further of	280	The Wumpus World Revisited – Topics 2
Probabilistic Reasoning   Representing Knowledge in an Uncertain Domain		·
Representing Knowledge in an Uncertain Domain Representing Knowledge in an Uncertain Domain Representing Knowledge in an Uncertain Domain Representation of Conditional Distributions – Topics 3 Relational and First-Order Probability Models – Topics 8 Relational and First-Order Probability Models – Topics 5 Relational and First-Order Probability Models – Topics 5 Relational and First-Order Probability Models – Topics 4 Summary, Bibliographical and Historical Notes, Exercises Probabilistic Reasoning Over Time Inference in temporal Models – Topics 3 Inference in temporal Models – Topics 3 Inference in temporal Models – Topics 5 Inference in temporal Models – Topics 5 Reping Track of Many Objects – Topics 7 Reping Track of Many Objects – Topics 2 Summary, Bibliographical and Historical Notes, Exercises Making Simple Decisions Romain Representations of Combining Belles and Desires Under Uncertainty Interest of Combining Belles and Desires Under Uncertainty Interest of Combining Belles and Desires Under Uncertainty Interest of Combining Belles and Desires Under Uncertainty Representation of Combining Reliefs and Representation of Representa		
The Semantics of Bayesian Networks — Topics 3	281	
Efficient Representation of Conditional Distributions — Topics 3 294 Exact Inference in Bayesian Networks — Topics 7 302 Approximate Inference in Bayesian Networks — Topics 8 308 Relational and First-Order Probability Models — Topics 5 310 Other Approaches to Uncertain Reasoning — Topics 4 Summary, Bibliographical and Historical Notes, Exercises Probabilistic Reasoning Over Time 314 Time and Uncertainty — Topics 3 319 Inference in temporal Models — Topics 5 322 Hidden Markov Models — Topics 3 323 Hidden Markov Models — Topics 3 324 Kalman Filters — Topics 5 325 Keeping Track of Many Objects — Topics 2 326 Summary, Bibliographical and Historical Notes, Exercises Making Simple Decisions 327 Combining Beliefs and Desires Under Uncertainty 337 Combining Beliefs and Desires Under Uncertainty 340 Utility Functions — Topics 4 341 The Basis of Utility Theory — Topics 3 343 Multiattribute Utility Theory — Topics 3 344 Utility Functions — Topics 5 345 Decision Networks — Topics 2 346 Summary, Bibliographical and Historical Notes, Exercises Making Complex Decisions 347 Decision Networks — Topics 2 348 Making Complex Decisions 349 Multiattribute Utility Functions — Topics 3 350 Decision Networks — Topics 4 361 Sequential Decisions 362 Value Iteration 363 Sequential Decision Problems — Topics 4 364 Sequential Decision Problems — Topics 4 365 Summary, Bibliographical and Historical Notes, Exercises Making Complex Decisions 365 Policy Iteration — Topics 4 366 Sequential Decision Problems — Topics 4 378 Mechanism Design — Topics 4 379 Poetisions with Multiple Agents: Game Theory — Topics 8 379 Poetision Step Residency Problems — Topics 8 379 Poetision Problems — Topics 9 380 Supervised Learning 381 Learning Decision Trees — Topics 8 382 Evaluating and Choosing the Best Hypothesis — Topics 5 383 Repression and Classification with Linear Models — Topics 5 384 Nother Resmole Residential Decision Step Section Problems — Topics 2 389 Repression and Classification with Linear Models — Topics 5 380 Support Vector Machines — Topics 2		
Exact Inference in Bayesian Networks – Topics 7		
Approximate Inference in Bayesian Networks – Topics 8		
307 Relational and First-Order Probability Models — Topics 5 311 Other Approaches to Uncertain Reasoning — Topics 4 Summary, Bibliographical and Historical Notes, Exercises  Probabilistic Reasoning Over Time 314 Time and Uncertainty — Topics 3 319 Inference in temporal Models — Topics 5 322 Hidden Markov Models — Topics 3 327 Kalman Filters — Topics 5 328 Joynamic Bayesian Networks — Topics 7 336 Keeping Track of Many Objects — Topics 2 Summary, Bibliographical and Historical Notes, Exercises  Making Simple Decisions 337 Combining Beliefs and Desires Under Uncertainty 341 The Basis of Utility Theory — Topics 4 346 Utility Functions — Topics 5 349 Multiattribute Utility Functions — Topics 3 351 Decision Networks — Topics 2 355 The Value of Information — Topics 4 357 Decision-Theoretic Expert Systems — Topics 2 358 Summary, IBibliographical and Historical Notes, Exercises  Making Complex Decisions 361 Sequential Decision Problems — Topics 4 362 Value Iteration 366 Policy Iteration — Topics 4 378 Mechanism Design — Topics 4 379 Decision with Multiple Agents: Game Theory — Topics 8 379 Mechanism Design — Topics 4 370 Summary, Bibliographical and Historical Notes, Exercises  Part-Os: Learning 480 Learning From Examples 481 Learning from Examples 482 Evaluating and Choosing the Best Hypothesis — Topics 4 383 Supervised Learning 384 Learning Decision Trees — Topics 8 385 Evaluating and Choosing the Best Hypothesis — Topics 4 386 Artificial Neural Networks — Topics 2 387 Regression and Classification with Linear Models — Topics 5 389 Regression and Classification with Linear Models — Topics 5 399 Regression and Classification with Linear Models — Topics 5 390 Regression and Classification with Linear Models — Topics 5 391 Practical Machine Learning — Topics 2 392 Supervised Learning — Topics 2 393 Supervised Learning — Topics 2 394 Supervised Learning — Topics 2 395 Supervised Learning — Topics 2 396 Supervised Learning — Topics 2 397 Support Vector Machines — Topics 2 398 Supervised Learning — Topics 2 399 Supervised	302	
Other Approaches to Uncertain Reasoning — Topics 4	307	
Probabilistic Reasoning Over Time	311	
Probabilistic Reasoning Over Time		
Time and Uncertainty - Topics 3   Inference in temporal Models - Topics 5   Inference in temporal Models - Topics 5   Inference in temporal Models - Topics 7   Inference in temporal Models - Topics 8   Inference in temporal Models - Topics 9   Inference in temporal Models - Inference in tem		
Inference in temporal Models – Topics 5	314	
Hidden Markov Models – Topics 3	319	
327 Kalman Filters – Topics 5 334 Dynamic Bayesian Networks – Topics 7 336 Keeping Track of Many Objects – Topics 2 Summary, Bibliographical and Historical Notes, Exercises  Making Simple Decisions 327 Combining Beliefs and Desires Under Uncertainty 331 The Basis of Utility Theory – Topics 4 342 Utility Functions – Topics 5 343 Multitatribute Utility Functions – Topics 3 343 Decision Networks – Topics 2 344 The Value of Information – Topics 4 345 Decision-Theoretic Expert Systems – Topics 2 346 Summary,   Bibliographical and Historical Notes, Exercises  Making Complex Decisions 347 Decision-Theoretic Expert Systems – Topics 2 348 Summary,   Bibliographical and Historical Notes, Exercises  Making Complex Decisions 340 Sequential Decision Problems – Topics 4 341 Decisions with Multiple Agents: Game Theory – Topics 8 342 Value Iteration 343 Decisions with Multiple Agents: Game Theory – Topics 8 344 Decisions with Multiple Agents: Game Theory – Topics 8 345 Mechanism Design – Topics 4 346 Summary, Bibliographical and Historical Notes, Exercises  Part-05: Learning  Learning from Examples 347 Forms of Learning 388 Learning Decision Trees – Topics 8 389 Supervised Learning 380 Supervised Learning 381 Regression and Classification with Linear Models – Topics 5 383 Regression and Classification with Linear Models – Topics 5 384 Nonparametric Models – Topics 2 385 Regression and Classification with Linear Models – Topics 5 386 Support Vector Machines – Topics 2 387 Ensemble Learning – Topics 2 388 Learning Decision Trees – Topics 5 389 Regression and Classification with Linear Models – Topics 5 380 Support Vector Machines – Topics 2 381 Ensemble Learning – Topics 2 382 Support Vector Machines – Topics 2 383 Support Regression and Classification with Linear Models – Topics 5 384 Learning Decision Trees – Topics 3 385 Support Vector Machines – Topics 2 386 Support Vector Machines – Topics 2 387 Support Vector Machines – Topics 3 388 Support Vector Machines – Topics 3 389 Support Vector Machines – Topics 3 389 Support Vecto		
334 Dynamic Bayesian Networks – Topics 7 336 Keeping Track of Many Objects – Topics 2 Summary, Bibliographical and Historical Notes, Exercises  Making Simple Decisions 337 Combining Beliefs and Desires Under Uncertainty 341 The Basis of Utility Theory – Topics 4 342 Utility Functions – Topics 5 343 Multiattribute Utility Functions – Topics 3 344 Multiatribute Utility Functions – Topics 3 345 Decision Networks – Topics 2 345 The Value of Information – Topics 4 357 Decision-Theoretic Expert Systems – Topics 2 Summary, [Bibliographical and Historical Notes, Exercises  Making Complex Decisions 361 Sequential Decision Problems – Topics 4 362 Value Iteration 366 Policy Iteration – Topics 4 374 Decisions with Multiple Agents: Game Theory – Topics 8 378 Mechanism Design – Topics 4 Summary, Bibliographical and Historical Notes, Exercises  Part-05: Learning Learning from Examples 379 Forms of Learning 380 Supervised Learning 381 Learning Decision Trees – Topics 8 382 Evaluating and Choosing the Best Hypothesis – Topics 4 384 The Theory of Learning – Topics 2 385 Regression and Classification with Linear Models – Topics 5 386 Autificial Neural Networks – Topics 7 387 Ensemble Learning – Topics 2 388 Autificial Neural Networks – Topics 6 389 Ensemble Learning – Topics 6 380 Support Vector Machines – Topics 6 381 Support Vector Machines – Topics 2 383 Ensemble Learning – Topics 2 384 Fractical Machine Learning – Topics 2 385 Summary, Bibliographical and Historical Notes, exercises 386 Knowledge in Learning – Topics 2 387 Ensemble Learning – Topics 2 388 Summary, Bibliographical and Historical Notes, exercises 388 Knowledge in Learning – Topics 2		·
Summary, Bibliographical and Historical Notes, Exercises  Making Simple Decisions  337 Combining Beliefs and Desires Under Uncertainty  341 The Basis of Utility Theory – Topics 4  346 Utility Functions – Topics 5  349 Multiattribute Utility Functions – Topics 3  351 Decision Networks – Topics 2  355 The Value of Information – Topics 4  357 Decision-Theoretic Expert Systems – Topics 2  Summary, [Bibliographical and Historical Notes, Exercises  Making Complex Decisions  361 Sequential Decision Problems – Topics 4  362 Value Iteration  366 Policy Iteration – Topics 4  374 Decisions with Multiple Agents: Game Theory – Topics 8  378 Mechanism Design – Topics 4  Summary, Bibliographical and Historical Notes, Exercises  Part-05: Learning  Learning from Examples  379 Forms of Learning  380 Supervised Learning  381 Learning Decision Trees – Topics 8  382 Evaluating and Choosing the Best Hypothesis – Topics 4  384 The Theory of Learning – Topics 2  385 Artificial Neural Networks – Topics 7  406 Artificial Neural Networks – Topics 6  407 Support Vector Machines – Topics 6  408 Support Vector Machines – Topics 7  409 Fraetolia Michael – Topics 7  400 Support Vector Machines – Topics 9  401 Ensemble Learning – Topics 9  402 Summary, Bibliographical and Historical Notes, exercises  Knowledge in Learning – Topics 2  Summary, Bibliographical and Historical Notes, exercises  Knowledge in Learning – Topics 2  Summary, Bibliographical and Historical Notes, exercises  Knowledge in Learning	334	·
Summary, Bibliographical and Historical Notes, Exercises  Making Simple Decisions 337 Combining Beliefs and Desires Under Uncertainty 341 The Basis of Utility Theory – Topics 4 346 Utility Functions – Topics 5 349 Multiattribute Utility Functions – Topics 3 351 Decision Networks – Topics 2 355 The Value of Information – Topics 4 357 Decision-Theoretic Expert Systems – Topics 2 358 Summary, Bibliographical and Historical Notes, Exercises  Making Complex Decisions 361 Sequential Decision Problems – Topics 4 362 Value Iteration 366 Policy Iteration – Topics 4 374 Decisions with Multiple Agents: Game Theory – Topics 8 378 Mechanism Design – Topics 4 379 Summary, Bibliographical and Historical Notes, Exercises  Part-05: Learning Learning from Examples 379 Forms of Learning 380 Supervised Learning 380 Supervised Learning 381 Learning Decision Trees – Topics 2 382 Evaluating and Choosing the Best Hypothesis – Topics 4 383 The Theory of Learning – Topics 2 384 Nonparametric Models – Topics 2 385 Regression and Classification with Linear Models – Topics 5 386 Support Vector Machines – Topics 6 387 Support Vector Machines – Topics 2 388 Learning Beign – Topics 3 389 Ensemble Learning – Topics 3 380 Support Vector Machines – Topics 6 380 Support Vector Machines – Topics 6 380 Support Vector Machines – Topics 2 380 Support Vector Machines – Topics 2 380 Support Vector Machines – Topics 3 380 Support Vector Machines – Topics 6 380 Support Vector Machines – Topics 2 380 Summary, Bibliographical and Historical Notes, exercises 380 Summary, Bibliographical and Historical Notes, exercises	336	
Making Simple Decisions 337 Combining Beliefs and Desires Under Uncertainty 341 The Basis of Utility Theory – Topics 4 346 Utility Functions – Topics 5 349 Multiattribute Utility Functions – Topics 3 351 Decision Networks – Topics 2 355 The Value of Information – Topics 4 357 Decision-Theoretic Expert Systems – Topics 2 Summary, Bibliographical and Historical Notes, Exercises  Making Complex Decisions 361 Sequential Decision Problems – Topics 4 362 Value Iteration 366 Policy Iteration – Topics 4 374 Decisions with Multiple Agents: Game Theory – Topics 8 378 Mechanism Design – Topics 4 379 Summary, Bibliographical and Historical Notes, Exercises  Part-05: Learning Learning from Examples 379 Forms of Learning 380 Supervised Learning 381 Learning Decision Trees – Topics 8 382 Evaluating and Choosing the Best Hypothesis – Topics 4 384 The Theory of Learning – Topics 2 389 Regression and Classification with Linear Models – Topics 5 408 Artificial Neural Networks – Topics 6 416 Support Vector Machines – Topics 2 419 Ensemble Learning – Topics 3 421 Practical Machine Learning – Topics 2 Summary, Bibliographical and Historical Notes, exercises Knowledge in Learning – Topics 2		
337 Combining Beliefs and Desires Under Uncertainty 341 The Basis of Utility Theory – Topics 4 346 Utility Functions – Topics 5 349 Multiatribute Utility Functions – Topics 3 351 Decision Networks – Topics 2 355 The Value of Information – Topics 4 357 Decision-Theoretic Expert Systems – Topics 2 358 Summary,   Bibliographical and Historical Notes, Exercises 360 Making Complex Decisions 361 Sequential Decision Problems – Topics 4 362 Value Iteration 366 Policy Iteration – Topics 4 374 Decisions with Multiple Agents: Game Theory – Topics 8 378 Mechanism Design – Topics 4 379 Summary, Bibliographical and Historical Notes, Exercises 379 Part-05: Learning 380 Supervised Learning 380 Supervised Learning 380 Evaluating and Choosing the Best Hypothesis – Topics 4 394 The Theory of Learning – Topics 2 399 Regression and Classification with Linear Models – Topics 5 408 Artificial Neural Networks – Topics 6 416 Support Vector Machines – Topics 2 419 Ensemble Learning – Topics 3 420 Practical Machine Learning – Topics 2 50 Summary, Bibliographical and Historical Notes, exercises 410 Practical Machine Learning – Topics 2 50 Summary, Bibliographical and Historical Notes, exercises 411 Practical Machine Learning – Topics 2 512 Summary, Bibliographical and Historical Notes, exercises 413 Practical Machine Learning – Topics 2 534 Summary, Bibliographical and Historical Notes, exercises 455 Summary, Bibliographical and Historical Notes, exercises 467 Summary, Bibliographical and Historical Notes, exercises 468 Knowledge in Learning		
341 The Basis of Utility Theory – Topics 4 346 Utility Functions – Topics 5 349 Multiattribute Utility Functions – Topics 3 351 Decision Networks – Topics 2 355 The Value of Information – Topics 4 357 Decision-Theoretic Expert Systems – Topics 2 358 Summary, JBibliographical and Historical Notes, Exercises 359 Making Complex Decisions 360 Sequential Decision Problems – Topics 4 361 Sequential Decision Problems – Topics 4 362 Value Iteration 366 Policy Iteration – Topics 4 374 Decisions with Multiple Agents: Game Theory – Topics 8 378 Mechanism Design – Topics 4 379 Summary, Bibliographical and Historical Notes, Exercises 379 Part-05: Learning 380 Learning from Examples 381 Learning Decision Trees – Topics 8 382 Evaluating and Choosing the Best Hypothesis – Topics 4 383 Learning Decision Trees – Topics 2 384 The Theory of Learning – Topics 2 385 Artificial Neural Networks – Topics 7 386 Artificial Neural Networks – Topics 6 387 Support Vector Machines – Topics 6 388 Support Vector Machines – Topics 6 389 Ensemble Learning – Topics 6 380 Support Vector Machines – Topics 6 381 Support Vector Machines – Topics 6 382 Support Vector Machines – Topics 6 383 Support Vector Machines – Topics 9 384 Practical Machine Learning – Topics 2 385 Summary, Bibliographical and Historical Notes, exercises 386 Summary, Bibliographical and Historical Notes, exercises 387 Knowledge in Learning	337	
346 Utility Functions – Topics 5 349 Multiattribute Utility Functions – Topics 3 351 Decision Networks – Topics 2 355 The Value of Information – Topics 4 357 Decision-Theoretic Expert Systems – Topics 2 Summary,   Bibliographical and Historical Notes, Exercises  Making Complex Decisions 361 Sequential Decision Problems – Topics 4 362 Value Iteration 366 Policy Iteration – Topics 4 374 Decisions with Multiple Agents: Game Theory – Topics 8 378 Mechanism Design – Topics 4 379 Summary, Bibliographical and Historical Notes, Exercises  Part-05: Learning Learning from Examples 379 Forms of Learning 380 Supervised Learning 381 Learning Decision Trees – Topics 8 392 Evaluating and Choosing the Best Hypothesis – Topics 4 394 The Theory of Learning – Topics 2 399 Regression and Classification with Linear Models – Topics 5 408 Artificial Neural Networks – Topics 6 416 Support Vector Machines – Topics 2 419 Ensemble Learning – Topics 3 421 Practical Machine Learning – Topics 2 Summary, Bibliographical and Historical Notes, exercises		
349 Multiattribute Utility Functions – Topics 3 351 Decision Networks – Topics 2 355 The Value of Information – Topics 4 357 Decision-Theoretic Expert Systems – Topics 2 Summary, Bibliographical and Historical Notes, Exercises  Making Complex Decisions 361 Sequential Decision Problems – Topics 4 362 Value Iteration 366 Policy Iteration – Topics 4 374 Decisions with Multiple Agents: Game Theory – Topics 8 378 Mechanism Design – Topics 4 389 Summary, Bibliographical and Historical Notes, Exercises  Part-05: Learning  Learning from Examples 379 Forms of Learning 380 Supervised Learning 381 Learning Decision Trees – Topics 8 392 Evaluating and Choosing the Best Hypothesis – Topics 4 394 The Theory of Learning – Topics 2 399 Regression and Classification with Linear Models – Topics 5 408 Artificial Neural Networks – Topics 7 414 Nonparametric Models – Topics 6 416 Support Vector Machines – Topics 3 421 Practical Machine Learning – Topics 2 Summary, Bibliographical and Historical Notes, exercises  Knowledge in Learning	346	. , ,
351 Decision Networks – Topics 2 355 The Value of Information – Topics 4 357 Decision-Theoretic Expert Systems – Topics 2 Summary,   Bibliographical and Historical Notes, Exercises  Making Complex Decisions 361 Sequential Decision Problems – Topics 4 362 Value Iteration 366 Policy Iteration – Topics 4 374 Decisions with Multiple Agents: Game Theory – Topics 8 378 Mechanism Design – Topics 4 Summary, Bibliographical and Historical Notes, Exercises  Part-05: Learning  Learning from Examples 379 Forms of Learning 380 Supervised Learning 381 Learning Decision Trees – Topics 8 392 Evaluating and Choosing the Best Hypothesis – Topics 4 394 The Theory of Learning – Topics 2 399 Regression and Classification with Linear Models – Topics 5 408 Artificial Neural Networks – Topics 7 414 Nonparametric Models – Topics 2 419 Ensemble Learning – Topics 2 419 Ensemble Learning – Topics 2 Summary, Bibliographical and Historical Notes, exercises  Knowledge in Learning		
355 The Value of Information – Topics 4 357 Decision-Theoretic Expert Systems – Topics 2 Summary,   Bibliographical and Historical Notes, Exercises  Making Complex Decisions 361 Sequential Decision Problems – Topics 4 362 Value Iteration 366 Policy Iteration – Topics 4 374 Decisions with Multiple Agents: Game Theory – Topics 8 378 Mechanism Design – Topics 4 Summary, Bibliographical and Historical Notes, Exercises  Part-05: Learning Learning from Examples 379 Forms of Learning 380 Supervised Learning 381 Learning Decision Trees – Topics 8 392 Evaluating and Choosing the Best Hypothesis – Topics 4 394 The Theory of Learning – Topics 2 399 Regression and Classification with Linear Models – Topics 5 408 Artificial Neural Networks – Topics 7 414 Nonparametric Models – Topics 2 419 Ensemble Learning – Topics 2 419 Ensemble Learning – Topics 3 421 Practical Machine Learning – Topics 2 Summary, Bibliographical and Historical Notes, exercises  Knowledge in Learning		
357 Decision-Theoretic Expert Systems – Topics 2 Summary,   Bibliographical and Historical Notes, Exercises  Making Complex Decisions  361 Sequential Decision Problems – Topics 4  362 Value Iteration 366 Policy Iteration – Topics 4  374 Decisions with Multiple Agents: Game Theory – Topics 8  378 Mechanism Design – Topics 4  Summary, Bibliographical and Historical Notes, Exercises  Part-05: Learning  Learning from Examples  379 Forms of Learning  380 Supervised Learning  381 Learning Decision Trees – Topics 8  392 Evaluating and Choosing the Best Hypothesis – Topics 4  394 The Theory of Learning – Topics 2  399 Regression and Classification with Linear Models – Topics 5  408 Artificial Neural Networks – Topics 7  414 Nonparametric Models – Topics 6  416 Support Vector Machines – Topics 2  419 Ensemble Learning – Topics 3  421 Practical Machine Learning – Topics 2  Summary, Bibliographical and Historical Notes, exercises  Knowledge in Learning		
Summary,   Bibliographical and Historical Notes, Exercises  Making Complex Decisions  361 Sequential Decision Problems – Topics 4  362 Value Iteration  366 Policy Iteration – Topics 4  374 Decisions with Multiple Agents: Game Theory – Topics 8  378 Mechanism Design – Topics 4  Summary, Bibliographical and Historical Notes, Exercises  Part-05: Learning  Learning from Examples  379 Forms of Learning  380 Supervised Learning  381 Learning Decision Trees – Topics 8  392 Evaluating and Choosing the Best Hypothesis – Topics 4  394 The Theory of Learning – Topics 2  399 Regression and Classification with Linear Models – Topics 5  408 Artificial Neural Networks – Topics 7  414 Nonparametric Models – Topics 6  416 Support Vector Machines – Topics 2  419 Ensemble Learning – Topics 2  Summary, Bibliographical and Historical Notes, exercises  Knowledge in Learning	357	'
361 Sequential Decision Problems – Topics 4 362 Value Iteration 366 Policy Iteration – Topics 4 374 Decisions with Multiple Agents: Game Theory – Topics 8 378 Mechanism Design – Topics 4 378 Summary, Bibliographical and Historical Notes, Exercises  Part-05: Learning  Learning from Examples 379 Forms of Learning 380 Supervised Learning 381 Learning Decision Trees – Topics 8 382 Evaluating Decision Trees – Topics 8 393 Evaluating and Choosing the Best Hypothesis – Topics 4 394 The Theory of Learning – Topics 2 399 Regression and Classification with Linear Models – Topics 5 408 Artificial Neural Networks – Topics 7 414 Nonparametric Models – Topics 6 416 Support Vector Machines – Topics 2 419 Ensemble Learning – Topics 3 421 Practical Machine Learning – Topics 2 Summary, Bibliographical and Historical Notes, exercises Knowledge in Learning		
362 Value Iteration 366 Policy Iteration – Topics 4 374 Decisions with Multiple Agents: Game Theory – Topics 8 378 Mechanism Design – Topics 4 Summary, Bibliographical and Historical Notes, Exercises  Part-05: Learning  Learning from Examples 379 Forms of Learning 380 Supervised Learning 381 Learning Decision Trees – Topics 8 392 Evaluating and Choosing the Best Hypothesis – Topics 4 394 The Theory of Learning – Topics 2 399 Regression and Classification with Linear Models – Topics 5 408 Artificial Neural Networks – Topics 6 416 Support Vector Machines – Topics 2 419 Ensemble Learning – Topics 3 421 Practical Machine Learning – Topics 2 Summary, Bibliographical and Historical Notes, exercises Knowledge in Learning		Making Complex Decisions
366 Policy Iteration – Topics 4 374 Decisions with Multiple Agents: Game Theory – Topics 8 378 Mechanism Design – Topics 4 Summary, Bibliographical and Historical Notes, Exercises  Part-05: Learning Learning from Examples 379 Forms of Learning 380 Supervised Learning 381 Learning Decision Trees – Topics 8 382 Evaluating and Choosing the Best Hypothesis – Topics 4 384 The Theory of Learning – Topics 2 385 Regression and Classification with Linear Models – Topics 5 408 Artificial Neural Networks – Topics 6 416 Support Vector Machines – Topics 2 419 Ensemble Learning – Topics 2 419 Ensemble Learning – Topics 2 5ummary, Bibliographical and Historical Notes, exercises Knowledge in Learning  Knowledge in Learning  Knowledge in Learning	361	Sequential Decision Problems – Topics 4
374 Decisions with Multiple Agents: Game Theory – Topics 8 378 Mechanism Design – Topics 4 Summary, Bibliographical and Historical Notes, Exercises  Part-05: Learning  Learning from Examples  379 Forms of Learning 380 Supervised Learning 381 Learning Decision Trees – Topics 8 382 Evaluating and Choosing the Best Hypothesis – Topics 4 384 The Theory of Learning – Topics 2 389 Regression and Classification with Linear Models – Topics 5 408 Artificial Neural Networks – Topics 7 414 Nonparametric Models – Topics 6 416 Support Vector Machines – Topics 2 419 Ensemble Learning – Topics 3 421 Practical Machine Learning – Topics 2 Summary, Bibliographical and Historical Notes, exercises  Knowledge in Learning  Knowledge in Learning	362	Value Iteration
378 Mechanism Design – Topics 4 Summary, Bibliographical and Historical Notes, Exercises  Part-05: Learning Learning from Examples 379 Forms of Learning 380 Supervised Learning 388 Learning Decision Trees – Topics 8 392 Evaluating and Choosing the Best Hypothesis – Topics 4 394 The Theory of Learning – Topics 2 399 Regression and Classification with Linear Models – Topics 5 408 Artificial Neural Networks – Topics 7 414 Nonparametric Models – Topics 6 416 Support Vector Machines – Topics 2 419 Ensemble Learning – Topics 3 421 Practical Machine Learning – Topics 2 Summary, Bibliographical and Historical Notes, exercises Knowledge in Learning	366	Policy Iteration – Topics 4
378 Mechanism Design – Topics 4 Summary, Bibliographical and Historical Notes, Exercises  Part-05: Learning Learning from Examples 379 Forms of Learning 380 Supervised Learning 388 Learning Decision Trees – Topics 8 392 Evaluating and Choosing the Best Hypothesis – Topics 4 394 The Theory of Learning – Topics 2 399 Regression and Classification with Linear Models – Topics 5 408 Artificial Neural Networks – Topics 7 414 Nonparametric Models – Topics 6 416 Support Vector Machines – Topics 2 419 Ensemble Learning – Topics 3 421 Practical Machine Learning – Topics 2 Summary, Bibliographical and Historical Notes, exercises Knowledge in Learning	374	
Part-05: Learning Learning from Examples  379 Forms of Learning 380 Supervised Learning 388 Learning Decision Trees – Topics 8  392 Evaluating and Choosing the Best Hypothesis – Topics 4  394 The Theory of Learning – Topics 2  399 Regression and Classification with Linear Models – Topics 5  408 Artificial Neural Networks – Topics 7  414 Nonparametric Models – Topics 6  416 Support Vector Machines – Topics 2  419 Ensemble Learning – Topics 3  421 Practical Machine Learning – Topics 2  Summary, Bibliographical and Historical Notes, exercises  Knowledge in Learning	378	
Learning from Examples  379 Forms of Learning  380 Supervised Learning  388 Learning Decision Trees – Topics 8  392 Evaluating and Choosing the Best Hypothesis – Topics 4  394 The Theory of Learning – Topics 2  399 Regression and Classification with Linear Models – Topics 5  408 Artificial Neural Networks – Topics 7  414 Nonparametric Models – Topics 6  416 Support Vector Machines – Topics 2  419 Ensemble Learning – Topics 3  421 Practical Machine Learning – Topics 2  Summary, Bibliographical and Historical Notes, exercises  Knowledge in Learning		Summary, Bibliographical and Historical Notes, Exercises
379 Forms of Learning 380 Supervised Learning 388 Learning Decision Trees – Topics 8 392 Evaluating and Choosing the Best Hypothesis – Topics 4 394 The Theory of Learning – Topics 2 399 Regression and Classification with Linear Models – Topics 5 408 Artificial Neural Networks – Topics 7 414 Nonparametric Models – Topics 6 416 Support Vector Machines – Topics 2 419 Ensemble Learning – Topics 3 421 Practical Machine Learning – Topics 2 Summary, Bibliographical and Historical Notes, exercises  Knowledge in Learning		Part-05: Learning
380 Supervised Learning 388 Learning Decision Trees – Topics 8 392 Evaluating and Choosing the Best Hypothesis – Topics 4 394 The Theory of Learning – Topics 2 399 Regression and Classification with Linear Models – Topics 5 408 Artificial Neural Networks – Topics 7 414 Nonparametric Models – Topics 6 416 Support Vector Machines – Topics 2 419 Ensemble Learning – Topics 3 421 Practical Machine Learning – Topics 2 Summary, Bibliographical and Historical Notes, exercises Knowledge in Learning		Learning from Examples
388 Learning Decision Trees – Topics 8 392 Evaluating and Choosing the Best Hypothesis – Topics 4 394 The Theory of Learning – Topics 2 399 Regression and Classification with Linear Models – Topics 5 408 Artificial Neural Networks – Topics 7 414 Nonparametric Models – Topics 6 416 Support Vector Machines – Topics 2 419 Ensemble Learning – Topics 3 421 Practical Machine Learning – Topics 2 Summary, Bibliographical and Historical Notes, exercises Knowledge in Learning	379	Forms of Learning
392 Evaluating and Choosing the Best Hypothesis – Topics 4 394 The Theory of Learning – Topics 2 399 Regression and Classification with Linear Models – Topics 5 408 Artificial Neural Networks – Topics 7 414 Nonparametric Models – Topics 6 416 Support Vector Machines – Topics 2 419 Ensemble Learning – Topics 3 421 Practical Machine Learning – Topics 2 Summary, Bibliographical and Historical Notes, exercises Knowledge in Learning	380	Supervised Learning
The Theory of Learning – Topics 2  Regression and Classification with Linear Models – Topics 5  Artificial Neural Networks – Topics 7  Nonparametric Models – Topics 6  Support Vector Machines – Topics 2  Ensemble Learning – Topics 3  Practical Machine Learning – Topics 2  Summary, Bibliographical and Historical Notes, exercises  Knowledge in Learning	388	Learning Decision Trees – Topics 8
399 Regression and Classification with Linear Models – Topics 5 408 Artificial Neural Networks – Topics 7 414 Nonparametric Models – Topics 6 416 Support Vector Machines – Topics 2 419 Ensemble Learning – Topics 3 421 Practical Machine Learning – Topics 2 Summary, Bibliographical and Historical Notes, exercises Knowledge in Learning	392	Evaluating and Choosing the Best Hypothesis – Topics 4
408 Artificial Neural Networks – Topics 7 414 Nonparametric Models – Topics 6 416 Support Vector Machines – Topics 2 419 Ensemble Learning – Topics 3 421 Practical Machine Learning – Topics 2 Summary, Bibliographical and Historical Notes, exercises Knowledge in Learning	394	The Theory of Learning – Topics 2
414 Nonparametric Models – Topics 6 416 Support Vector Machines – Topics 2 419 Ensemble Learning – Topics 3 421 Practical Machine Learning – Topics 2 Summary, Bibliographical and Historical Notes, exercises Knowledge in Learning	399	Regression and Classification with Linear Models – Topics 5
416 Support Vector Machines – Topics 2 419 Ensemble Learning – Topics 3 421 Practical Machine Learning – Topics 2 Summary, Bibliographical and Historical Notes, exercises Knowledge in Learning	408	Artificial Neural Networks – Topics 7
419 Ensemble Learning – Topics 3  421 Practical Machine Learning – Topics 2  Summary, Bibliographical and Historical Notes, exercises  Knowledge in Learning	414	Nonparametric Models – Topics 6
421 Practical Machine Learning – Topics 2 Summary, Bibliographical and Historical Notes, exercises Knowledge in Learning	416	Support Vector Machines – Topics 2
Summary, Bibliographical and Historical Notes, exercises  Knowledge in Learning	419	Ensemble Learning – Topics 3
Knowledge in Learning	421	Practical Machine Learning – Topics 2
•		Summary, Bibliographical and Historical Notes, exercises
425 A Logical Formulation of Learning – Topics 4		•
	425	A Logical Formulation of Learning – Topics 4

428	Knowledge in Learning – Topics 3
431	Explanation-Based Learning – Topics 3
434	Learning Using Relevance Information – Topics 3
440	Inductive Logic Programming – Topics 6
110	Summary, Bibliographical and Historical Notes, Exercises
	Learning Probabilistic Models
442	Statistical Learning – Topics 2
448	Learning with Complete Data – Topics 6
454	Learning with Hidden Variables: The EM Algorithm – Topics 6
131	Summary, Bibliographical and Historical Notes, Exercises
	Reinforcement Learning
455	Introduction
459	Passive Reinforcement Learning – Topics 4
463	Active Reinforcement Learning – Topics 4
464	Generalization in Reinforcement Learning
465	Policy Search
467	Applications of Reinforcement Learning – Topics 2
407	Summary, Bibliographical and Historical Notes, Exercises
	Part-6: Communication, Perceiving, and Acting
	Natural Language Processing
471	Language Models – Topics 4
473	Text Classification – Topics 2
478	Information Retrieval – Topics 5
485	Information Extraction – Topics 7
403	Summary, Bibliographical and Historical Notes, Exercises
	Natural Language for Communication
488	Phrase Structure Grammars – Topics 3
492	Syntactic Analysis (Parsing) – Topics 4
498	Augmented Grammars and Semantic Interpretation – Topics 6
502	Machine Translation – Topics 4
506	Speech Recognition – Topics 4
300	Summary, Bibliographical and Historical Notes, Exercises
	Perception
512	Image Formation – Topics 6
518	Early Image-Processing Operations – Topics 6
521	Object Recognition by Appearance – Topics 3
528	Reconstructing the 3D World – Topics 7
531	Object Recognition from Structural Information – Topics 3
535	Using Vision – Topics 4
333	Summary, bibliographical and Historical Notes, Exercises
	Robotics
536	Introduction
539	Robot Hardware – Topics 3
544	Robotic Perception – Topics 5
550	Planning to Move – Topics 6
553	Planning Uncertain Movements – Topics 3
557	Moving – Topics 4
560	Robotic Software Architectures – Topics 3
562	Application Domains – Topics 2
002	Summary, Bibliographical and Historical Notes, Exercises
	Part-07: Conclusions
	1.

	Philosophical Foundations
566	Weak AI: Can Machines Act Intelligently? – Topics 4
571	Strong AI: Can Machines Really Think? – Topics 5
574	The Ethics and Risks of Developing Artificial Intelligence – Topics 3
	Summary, Bibliographical and Historical Notes, Exercises
	AI: The Present and Future
575	Agent Components
576	Agent Architectures
577	Are We Going in the Right Direction?
578	What If AI Does Succeed?
	Mathematical Background
580	Complexity Analysis and O() Notation – Topics 2
581	Vectors, Matrices, and Linear Algebra
582	Probability Distributions
	Notes on Languages and Algorithms
583	Defining Languages with Backus-Naur Form (BNF)
584	Describing Algorithms with Pseudocode
585	Online Help

## Machine Learning

Machine Learning: Reference-1

	Machine Learning Refined: Foundations, Algorithms, and Applications
	Introduction
04	Teaching a Computer to Distinguish Cats from Dogs – Topics 4
08	Predictive Learning Problems – Topics 4
10	Feature Design – Topics 2
11	Numerical Optimization
12	Summary
12	Part-01: Fundamental Tools and Concepts
	Fundamentals of Numerical Optimization
16	Calculus-Defined Optimality – Topics 3
22	Numerical Methods for Optimization – Topics 6
23	Summary
23	Exercises
	Regression
28	The Basics of Linear Regression – Topics 5
31	Knowledge-Driven Feature Design for Regression – Topics 3
34	Nonlinear Regression and E2 Regularization – Topics 3
35	Summary
33	Exercises
	Classification
39	The Perceptron Cost Functions – Topics 4
43	The Perceptron Cost Functions – Topics 4  The Perceptron Cost Functions – Topics 4
45	The Logistic Regression Perspective on the Softmax Cost – Topics 2
49	
53	The Support Vector Machine Perspective on the Margin Perceptron – Topics 4  Multiclass Classification – Topics 4
54	Knowledge-Driven Feature Design for Classification – Topics 1
59	Histogram Features for Real Data Types – Topics 3
60	
60	Summary Exercises
	Part-02: Tools for Fully Data-Dirven Machine Learning
62	Automatic Feature Design for Regression
63	Automatic Feature Design for the Ideal Regression Scenario – Topics 3
66	Automatic Feature Design for the Ideal Regression Scenario – Topics 3
68	Automatic Feature Design for the Real Regression Scenario – Topics 2
72	Cross-Validation for Regression – Topics 4
75	Which Basis Works Best? – Topics 3
76	Summary
77	Exercises
77	Notes on Continuous Function Approximation
0.1	Automatic Feature Design for Classification
81	Automatic Feature Design for the Ideal Classification Scenario – Topics 4
84	Automatic Feature Design for the Real Classification Scenario – Topics 3
86	Multiclass Classification – Topics 2
90	Cross-Validation for Classification – Topics 4
91	Which Basis Works Best?
92	Summary
	Exercises

	Kernels, Backpropagation, and Regularized Cross-Validation
97	Fixed Feature Kernels – Topics 5
100	The Backpropagation Algorithm – Topics 3
103	Cross-Validation via L2 Regularization – Topics 3
104	Summary
107	Further Kernel Calculations – Topics 3
	Part-03: Methods for Large Scale Machine Learning
	Advanced Gradient Schemes
110	Fixed Step Length Rules for Gradient Descent – Topics 3
112	Adaptive Step Length Rules for Gradient Descent – Topics 2
117	Stochastic Gradient Descent – Topics 5
121	Convergence Proofs for Gradient Descent Schemes – Topics 4
122	Calculation of Computable Lipschitz Constants
123	Summary
	Exercises
	Dimension Reduction Techniques
126	Techniques for Data Dimension Reduction – Topics 3
127	Principal Component Analysis – Topics 1
129	Recommender Systems – Topics 2
130	Summary
	Exercises
	Part-04: Appendices
	Basic vector and Matrix Operations
131	Vector Operations
132	Matrix Operations
	Basic of Vector Calculus
133	Basic Definitions
134	Commonly Used Rules for Computing Derivative
135	Examples of Gradient and Hessian Calculations
	Fundamental Matrix Factorizations and The Pseudo-Inverse
138	Fundamental Matrix Factorizations – Topics 3
	Convex Geometry
140	Definitions of Convexity – Topics 2

#### Machine Learning: Reference-2

	Hands-on Machine Learning with Scikit-Learn, Keras & TensorFlow
	Part-01: The Fundamentals of Machine Learning
	The Machine Learning Landscape
01	What is Machine Learning?
02	Why Use Machine Learning?
05	Types of Machine Learning Systems – Topics 3
12	Main Challenges of Machine Learning – Topics 7
14	Testing and Validating – Topics 2
15	Exercise
	End-to-End Machine Learning Project
16	Working with Real Data
19	Look at the Big Picture – Topics 3
23	Get the Data – Topics 4
26	Discover and Visualize the Data to Gain Insights – Topics 3
31	Prepare the Data for Machine Learning Algorithms – Topics 5
33	Select and Train a Model – Topics 2
38	Fine-Tune Your Model – Topics 5
39	Launch, Monitor, and Maintain Your System
40	Try It Out!
41	Exercises
	Classification
42	MNIST
43	Training a Binary Classifier
48	Performance Measures – Topics 5
49	Multiclass Classification
50	Error Analysis
51	Multilevel Classification
52	Multi-output Classification
53	Exercises
	Training Models
55	Linear Regression – Topics 2
58	Gradient Descent – Topics 3
59	Polynomial regression
60	Learning Curves
64	Regularized Linear Models – Topics 4
68	Logistic Regression – Topics 4
69	Exercises
	Support Vector Machines
71	Linear SVM Classification   Soft Margin Classification
75	Nonlinear SVM Classification – Topics 4
76	SVM Regression
82	Under the Hood – Topics 6
83	Exercise
	Decision Trees
84	Training and Visualizing a Decision Tree
85	Making Predictions
86	Estimating Class Probabilities
87	The CART Training Algorithm

88	Computational Complexity
89	Gini Impurity or Entropy?
90	Regularization Hyper-parameters
91	Regression
92	Instability
93	Exercises
	Ensemble Learning and Random Forests
94	Voting Classifiers
96	Bagging and Pasting – Topics 2
97	Random Patches and Random Subspaces
99	Random Forests – Topics 2
101	Boosting – Topics 2
102	Stacking
103	Exercises
	Dimensionality Reduction
104	The Curse of Dimensionality
106	Main Approaches for Dimensionality Reduction – Topics 2
115	PCA – Topics 9
117	Kernel PCA   Selecting a Kernel and Tuning Hyper-parameters
118	LLE
119	Other Dimensionality Reduction Techniques
120	Exercises
	Unsupervised Learning Techniques
127	Clustering – Topics 7
131	Gaussian Mixtures – Topics 4
	Part-02: Neural Networks and Deep Learning
	Part-02: Neural Networks and Deep Learning Introduction to Artificial Neural Networks with Keras
137	Part-02: Neural Networks and Deep Learning Introduction to Artificial Neural Networks with Keras From Biological to Artificial Neurons – Topics 6
137 145	Part-02: Neural Networks and Deep Learning Introduction to Artificial Neural Networks with Keras From Biological to Artificial Neurons – Topics 6 Implementing MLPs with Keras – Topics 8
137 145 148	Part-02: Neural Networks and Deep Learning Introduction to Artificial Neural Networks with Keras From Biological to Artificial Neurons – Topics 6 Implementing MLPs with Keras – Topics 8 Fine-Tuning Neural Network hyper-parameters – Topics 3
137 145	Part-02: Neural Networks and Deep Learning Introduction to Artificial Neural Networks with Keras From Biological to Artificial Neurons – Topics 6 Implementing MLPs with Keras – Topics 8 Fine-Tuning Neural Network hyper-parameters – Topics 3 Exercises
137 145 148 149	Part-02: Neural Networks and Deep Learning Introduction to Artificial Neural Networks with Keras From Biological to Artificial Neurons – Topics 6 Implementing MLPs with Keras – Topics 8 Fine-Tuning Neural Network hyper-parameters – Topics 3 Exercises Training Deep Neural Networks
137 145 148 149	Part-02: Neural Networks and Deep Learning Introduction to Artificial Neural Networks with Keras From Biological to Artificial Neurons – Topics 6 Implementing MLPs with Keras – Topics 8 Fine-Tuning Neural Network hyper-parameters – Topics 3 Exercises Training Deep Neural Networks Vanishing/Exploding Gradients Problems – Topics 4
137 145 148 149 153 156	Part-02: Neural Networks and Deep Learning Introduction to Artificial Neural Networks with Keras From Biological to Artificial Neurons – Topics 6 Implementing MLPs with Keras – Topics 8 Fine-Tuning Neural Network hyper-parameters – Topics 3 Exercises Training Deep Neural Networks Vanishing/Exploding Gradients Problems – Topics 4 Reusing Pretrained Layers – Topics 3
137 145 148 149 153 156 162	Part-02: Neural Networks and Deep Learning Introduction to Artificial Neural Networks with Keras From Biological to Artificial Neurons – Topics 6 Implementing MLPs with Keras – Topics 8 Fine-Tuning Neural Network hyper-parameters – Topics 3 Exercises Training Deep Neural Networks Vanishing/Exploding Gradients Problems – Topics 4 Reusing Pretrained Layers – Topics 3 Faster Optimizers – Topics 6
137 145 148 149 153 156 162 166	Part-02: Neural Networks and Deep Learning Introduction to Artificial Neural Networks with Keras From Biological to Artificial Neurons – Topics 6 Implementing MLPs with Keras – Topics 8 Fine-Tuning Neural Network hyper-parameters – Topics 3 Exercises Training Deep Neural Networks Vanishing/Exploding Gradients Problems – Topics 4 Reusing Pretrained Layers – Topics 3 Faster Optimizers – Topics 6 Avoiding Overfitting Through Regularization – Topics 4
137 145 148 149 153 156 162 166 167	Part-02: Neural Networks and Deep Learning Introduction to Artificial Neural Networks with Keras From Biological to Artificial Neurons – Topics 6 Implementing MLPs with Keras – Topics 8 Fine-Tuning Neural Network hyper-parameters – Topics 3 Exercises Training Deep Neural Networks Vanishing/Exploding Gradients Problems – Topics 4 Reusing Pretrained Layers – Topics 3 Faster Optimizers – Topics 6 Avoiding Overfitting Through Regularization – Topics 4 Summary and Practical Guidelines
137 145 148 149 153 156 162 166	Part-02: Neural Networks and Deep Learning Introduction to Artificial Neural Networks with Keras From Biological to Artificial Neurons – Topics 6 Implementing MLPs with Keras – Topics 8 Fine-Tuning Neural Network hyper-parameters – Topics 3 Exercises Training Deep Neural Networks Vanishing/Exploding Gradients Problems – Topics 4 Reusing Pretrained Layers – Topics 3 Faster Optimizers – Topics 6 Avoiding Overfitting Through Regularization – Topics 4 Summary and Practical Guidelines Exercises
137 145 148 149 153 156 162 166 167 168	Part-02: Neural Networks and Deep Learning Introduction to Artificial Neural Networks with Keras From Biological to Artificial Neurons – Topics 6 Implementing MLPs with Keras – Topics 8 Fine-Tuning Neural Network hyper-parameters – Topics 3 Exercises Training Deep Neural Networks Vanishing/Exploding Gradients Problems – Topics 4 Reusing Pretrained Layers – Topics 3 Faster Optimizers – Topics 6 Avoiding Overfitting Through Regularization – Topics 4 Summary and Practical Guidelines Exercises Custom Models and Training with TensorFlow
137 145 148 149 153 156 162 166 167 168	Part-02: Neural Networks and Deep Learning Introduction to Artificial Neural Networks with Keras From Biological to Artificial Neurons – Topics 6 Implementing MLPs with Keras – Topics 8 Fine-Tuning Neural Network hyper-parameters – Topics 3 Exercises Training Deep Neural Networks Vanishing/Exploding Gradients Problems – Topics 4 Reusing Pretrained Layers – Topics 3 Faster Optimizers – Topics 6 Avoiding Overfitting Through Regularization – Topics 4 Summary and Practical Guidelines Exercises Custom Models and Training with TensorFlow A Quick Tour of Tensor Flow
137 145 148 149 153 156 162 166 167 168	Part-02: Neural Networks and Deep Learning Introduction to Artificial Neural Networks with Keras From Biological to Artificial Neurons – Topics 6 Implementing MLPs with Keras – Topics 8 Fine-Tuning Neural Network hyper-parameters – Topics 3 Exercises Training Deep Neural Networks Vanishing/Exploding Gradients Problems – Topics 4 Reusing Pretrained Layers – Topics 3 Faster Optimizers – Topics 6 Avoiding Overfitting Through Regularization – Topics 4 Summary and Practical Guidelines Exercises  Custom Models and Training with TensorFlow A Quick Tour of Tensor Flow Using TensorFlow like NumPy – Topics 5
137 145 148 149 153 156 162 166 167 168	Introduction to Artificial Neural Networks with Keras From Biological to Artificial Neurons – Topics 6 Implementing MLPs with Keras – Topics 8 Fine-Tuning Neural Network hyper-parameters – Topics 3 Exercises  Training Deep Neural Networks Vanishing/Exploding Gradients Problems – Topics 4 Reusing Pretrained Layers – Topics 3 Faster Optimizers – Topics 6 Avoiding Overfitting Through Regularization – Topics 4 Summary and Practical Guidelines Exercises  Custom Models and Training with TensorFlow A Quick Tour of Tensor Flow Using TensorFlow like NumPy – Topics 5 Customizing Models and Training Algorithms – Topics 9
137 145 148 149 153 156 162 166 167 168	Introduction to Artificial Neural Networks with Keras From Biological to Artificial Neurons – Topics 6 Implementing MLPs with Keras – Topics 8 Fine-Tuning Neural Network hyper-parameters – Topics 3 Exercises Training Deep Neural Networks Vanishing/Exploding Gradients Problems – Topics 4 Reusing Pretrained Layers – Topics 3 Faster Optimizers – Topics 6 Avoiding Overfitting Through Regularization – Topics 4 Summary and Practical Guidelines Exercises Custom Models and Training with TensorFlow A Quick Tour of Tensor Flow Using TensorFlow like NumPy – Topics 5 Customizing Models and Training Algorithms – Topics 9 TensorFlow Functions and Graphs – Topics 2
137 145 148 149 153 156 162 166 167 168 169 174 183 185	Introduction to Artificial Neural Networks with Keras From Biological to Artificial Neurons – Topics 6 Implementing MLPs with Keras – Topics 8 Fine-Tuning Neural Network hyper-parameters – Topics 3 Exercises  Training Deep Neural Networks Vanishing/Exploding Gradients Problems – Topics 4 Reusing Pretrained Layers – Topics 3 Faster Optimizers – Topics 6 Avoiding Overfitting Through Regularization – Topics 4 Summary and Practical Guidelines Exercises  Custom Models and Training with TensorFlow A Quick Tour of Tensor Flow Using TensorFlow like NumPy – Topics 5 Customizing Models and Training Algorithms – Topics 9 TensorFlow Functions and Graphs – Topics 2 Loading and Preprocessing Data with TensorFlow
137 145 148 149 153 156 162 166 167 168 169 174 183 185	Introduction to Artificial Neural Networks with Keras From Biological to Artificial Neurons – Topics 6 Implementing MLPs with Keras – Topics 8 Fine-Tuning Neural Network hyper-parameters – Topics 3 Exercises  Training Deep Neural Networks Vanishing/Exploding Gradients Problems – Topics 4 Reusing Pretrained Layers – Topics 3 Faster Optimizers – Topics 6 Avoiding Overfitting Through Regularization – Topics 4 Summary and Practical Guidelines Exercises  Custom Models and Training with TensorFlow A Quick Tour of Tensor Flow Using TensorFlow like NumPy – Topics 5 Customizing Models and Training Algorithms – Topics 9 TensorFlow Functions and Graphs – Topics 2 Loading and Preprocessing Data with TensorFlow The Data API – Topics 6
137 145 148 149 153 156 162 166 167 168 169 174 183 185	Introduction to Artificial Neural Networks with Keras From Biological to Artificial Neurons – Topics 6 Implementing MLPs with Keras – Topics 8 Fine-Tuning Neural Network hyper-parameters – Topics 3 Exercises  Training Deep Neural Networks Vanishing/Exploding Gradients Problems – Topics 4 Reusing Pretrained Layers – Topics 3 Faster Optimizers – Topics 6 Avoiding Overfitting Through Regularization – Topics 4 Summary and Practical Guidelines Exercises  Custom Models and Training with TensorFlow A Quick Tour of Tensor Flow Using TensorFlow like NumPy – Topics 5 Customizing Models and Training Algorithms – Topics 9 TensorFlow Functions and Graphs – Topics 2 Loading and Preprocessing Data with TensorFlow The Data API – Topics 6 The TFRecord Format – Topics 5
137 145 148 149 153 156 162 166 167 168 169 174 183 185	Introduction to Artificial Neural Networks with Keras From Biological to Artificial Neurons – Topics 6 Implementing MLPs with Keras – Topics 8 Fine-Tuning Neural Network hyper-parameters – Topics 3 Exercises  Training Deep Neural Networks Vanishing/Exploding Gradients Problems – Topics 4 Reusing Pretrained Layers – Topics 3 Faster Optimizers – Topics 6 Avoiding Overfitting Through Regularization – Topics 4 Summary and Practical Guidelines Exercises  Custom Models and Training with TensorFlow A Quick Tour of Tensor Flow Using TensorFlow like NumPy – Topics 5 Customizing Models and Training Algorithms – Topics 9 TensorFlow Functions and Graphs – Topics 2 Loading and Preprocessing Data with TensorFlow The Data API – Topics 6 The TFRecord Format – Topics 5 The Features API – Topics 5
137 145 148 149 153 156 162 166 167 168 169 174 183 185 191 196 202 203	Introduction to Artificial Neural Networks with Keras From Biological to Artificial Neurons – Topics 6 Implementing MLPs with Keras – Topics 8 Fine-Tuning Neural Network hyper-parameters – Topics 3 Exercises Training Deep Neural Networks Vanishing/Exploding Gradients Problems – Topics 4 Reusing Pretrained Layers – Topics 3 Faster Optimizers – Topics 6 Avoiding Overfitting Through Regularization – Topics 4 Summary and Practical Guidelines Exercises  Custom Models and Training with TensorFlow A Quick Tour of Tensor Flow Using TensorFlow like NumPy – Topics 5 Customizing Models and Training Algorithms – Topics 9 TensorFlow Functions and Graphs – Topics 2 Loading and Preprocessing Data with TensorFlow The Data API – Topics 6 The Freatures API – Topics 6 TF Transform
137 145 148 149 153 156 162 166 167 168 169 174 183 185	Introduction to Artificial Neural Networks with Keras From Biological to Artificial Neurons – Topics 6 Implementing MLPs with Keras – Topics 8 Fine-Tuning Neural Network hyper-parameters – Topics 3 Exercises Training Deep Neural Networks Vanishing/Exploding Gradients Problems – Topics 4 Reusing Pretrained Layers – Topics 3 Faster Optimizers – Topics 6 Avoiding Overfitting Through Regularization – Topics 4 Summary and Practical Guidelines Exercises  Custom Models and Training with TensorFlow A Quick Tour of Tensor Flow Using TensorFlow like NumPy – Topics 5 Customizing Models and Training Algorithms – Topics 9 TensorFlow Functions and Graphs – Topics 2 Loading and Preprocessing Data with TensorFlow The Data API – Topics 6 The TFRecord Format – Topics 5 The Features API – Topics 6 TF Transform The TensorFlow Datasets (TFDS) Project
137 145 148 149 153 156 162 166 167 168 169 174 183 185 191 196 202 203	Introduction to Artificial Neural Networks with Keras From Biological to Artificial Neurons – Topics 6 Implementing MLPs with Keras – Topics 8 Fine-Tuning Neural Network hyper-parameters – Topics 3 Exercises Training Deep Neural Networks Vanishing/Exploding Gradients Problems – Topics 4 Reusing Pretrained Layers – Topics 3 Faster Optimizers – Topics 6 Avoiding Overfitting Through Regularization – Topics 4 Summary and Practical Guidelines Exercises  Custom Models and Training with TensorFlow A Quick Tour of Tensor Flow Using TensorFlow like NumPy – Topics 5 Customizing Models and Training Algorithms – Topics 9 TensorFlow Functions and Graphs – Topics 2 Loading and Preprocessing Data with TensorFlow The Data API – Topics 6 The Freatures API – Topics 6 TF Transform

209	Convolutional Layer – Topics 4
211	Pooling Layer   TensorFlow Implementation
218	CNN Architectures – Topics 7
219	Implementing a ResNet-34 CN Using Keras
220	Using Pretrained Models From Keras
221	Pretrained Models for Transfer Learning
222	Classification and Localization
224	Object Detection – Topics 2
225	Semantic Segmentation
226	Exercises

### Machine Learning: Reference-3

	Deep Learning
	Introduction
03	Introduction – Topics 3
04	Who Should Read This Book?
12	Historical trends in Deep Learning – Topics 8
12	Part-01: Applied Math and Machine Learning Basics
	Linear Algebra
13	Scalars, vectors, Matrices and Tensors
14	Multiplying Matrices and Vectors
15	Identity and Inverse Matrices
16	Linear Dependence and Span
17	Norms
18	Special Kinds of Matrices and Vectors
19	Enigendecomposition
20	Singular Value Decomposition
21	The Moore-Penrose Pseudoinverse
22	The Trace Operator
23	The Determinant
26	Example: Principal Components Analysis – Topics 3
20	Probability and Information Theory
29	Why Probability? – Topics 3
30	Random Variables
32	Probability Distributions – Topics 2
33	Marginal Probability
34	Conditional Probability
35	The Chain Rule of Conditional Probabilities
36	Independence and Conditional Independence
37	Expectation, Variance and Covariance
38	Common Probability Distributions
39	Useful Properties of Continuous Variables
40	Information Theory
41	Structured Probabilistic Models
	Numerical Computation
42	Overflow and Underflow
43	Poor Conditioning
44	Gradient-Based Optimization
45	Constrained Optimization
46	Example: Linear Least Squares
	Machine Learning Basics
47	Learning Algorithms
48	Capacity, Overfitting and Under-fitting
59	Hyper-parameters and Validation Sets
50	Estimators, Bias and Variance
51	Maximum Likelihood Estimation
52	Bayesian Statistics
53	Supervised Learning Algorithms
54	Unsupervised Learning Algorithms
55	Stochastic Gradient Descent

56	Building a Machine Learning Algorithm
57	Challenges Motivation Deep Learning
	Part-02: Deep Networks: Modern Practices
	Deep Feedforward Networks
58	Example: Learning XOR
59	Gradient-Based Learning
60	Hidden Units
61	Architecture Design
62	Back-Propagation and Other Differentiation Algorithms
63	Historical Notes
	Regularization for Deep Learning
64	Parameter Norm Penalties
65	Norm Penalties as Constrained Optimization
66	Regularization and Under-Constrained Problems
67	Dataset Augmentation
68	Noise Robustness
69	Semi-Supervised Learning
70	Multi-Task Learning
71	Early Stopping
72	Parameter Tying and Parameter Sharing
73	Sparse Representations
74	Bagging and Other Ensemble Method
75	Dropout
76	Adversarial Training
77	Tangent Distance, Tangent Prop, and Manifold Tangent Classifier
	Optimization for Training Deep Models
78	How Learning Differs from Pure Optimization
79	Challenges in Neural Network Optimization
80	Basic Algorithms
81	Parameter Initialization Strategies
82	Algorithms with Adaptive Learning Rates
83	Approximate Second-Order Methods
84	Optimization Strategies and Meta-Algorithms
	Convolutional Networks
85	The Convolution Operation
86	Motivation
87	Polling
88	Convolution and Pooling as an Infinitely Strong Prior
89	Variants for the Basic Convolution Function
90	Structured Outputs
91	Data Types
92	Efficient Convolution Algorithms
93	Random or Unsupervised Features
94	The Neuroscientific Basis for Convolutional Networks
95	Convolutional Network and the History of Deep Learning
	Sequence Modeling: Recurrent and Recursive Nets
96	Unfolding Computational Graphs
97	Recurrent Neural Networks
98	Bidirectional RNNs
99	Encoder-Decoder Sequence-to-Sequence Architectures
100	Deep Recurrent Networks

101	The Challenge of Long-Term Dependencies
102	Echo State Networks
103	Leaky Units and Other Strategies for Multiple Time Scales
104	The Long Short-Term Memory and Other Gated RNNs
105	Optimization for Long-Term Dependencies
106	Explicit Memory
100	Practical Methodology
107	Performance Metrics
108	Default Baseline Models
109	Determining Whether to Gather More Data
110	Selecting Hyper-parameters
111	Debugging Strategies
112	Example: Multi-Digit Number Recognition
112	Applications
113	Large-Scale Deep Learning
114	Computer Vision
115	Speech Recognition
116	Natural Language Processing
117	Other Applications
` `	Part-03: Deep Learning Research
	Linear Factor Models
118	Probabilistic PCA and Factor Analysis
119	Independ Component Analysis (ICA)
120	Show Feature Analysis
121	Sparse Coding
122	Manifold Interpretation of PCA
122	Auto-encoder
123	Under-complete Auto-encoders
124	Regularized Auto-encoders
125	Representational Power, Layer Size and Depth
126	Stochastic Encoders and Decoders
127	Denoising Auto-encoders
128	Learning Manifolds with Auto-encoders
129	Contractive Auto-encoders
130	Predictive Sparse Decomposition
131	Applications of Auto-encoders
131	Representation Learning
132	Greedy Layer-Wise Unsupervised Pre-training
133	Transfer Learning and Domain Adaptation
134	Semi-Supervised Disentangling of Causal Factors
135	Distributed Representation
136	Exponential Gains from Depth
137	Providing Clues to Discover Underlying Causes
137	Structured Probabilistic Models for Deep Learning
138	The Challenge of Unstructured Modeling
138	Using Graphs to Describe Model Structure
140 141	Sampling from Graphical Models Advantages of Structured Modeling
141	Learning about Dependencies
142	
143	Inference and Approximate Inference  The Doop Learning Approach to Structured Probabilistic Models
144	The Deep Learning Approach to Structured Probabilistic Models

	Monte Carlo Methods
145	Sampling and Monte Carlo Methods
146	Importance Sampling
147	Markov Chain Monte Carlo Methods
148	Gibbs Sampling
149	The Challenge of Mixing Between Separated Modes
	Confronting the Partition Function
150	The Log-Likelihood Gradient
151	Stochastic Maximum Likelihood and Contrastive Divergence
152	Pseudolikelihood
153	Score Matching and Ratio Matching
154	Denoising Score Matching
155	Noise-Contrastive Estimation
156	Estimating the Partition Function
	Approximate Inference
157	Inference as Optimization
158	Expectation Maximization
159	MAP Inference and Sparse Coding
160	Variational Inference and Learning
161	Learned Approximate Inference
	Deep Generative Models
162	Boltzmann Machines
163	Restricted Boltzmann Machines
164	Deep Belief Networks
165	Deep Boltzmann Machines
166	Boltzmann Machines for Real-Valued Data
167	Convolutional Boltzmann Machines
168	Boltzmann Machines for Structured or Sequential Outputs
169	Other Boltzmann Machines
170	Back-Propagation Through Random Operations
171	Directed Generative Nets
172	Drawing Samples from Auto-encoders
173	Generative Stochastic Networks
174	Other Generation Schemes
175	Evaluating Generative Models
176s	Conclusion

#### **Data Science**

Data Science: Reference-1

	Introducing Data Cairman Die Data Marking Laureing and Mark
	Introducing Data Science: Big Data, Machine Learning and More
01	Data Science in a big Data World
01	Benefits and Uses of Data Science and Big Data
08	Facets of Data – Topics 7
14	The Data Science Process – Topics 6
25	The Big Data Ecosystem and Data Science – Topics 11
26	An Introductory Working Example of Hadoop
27	Summary The Date Grieves Bresses
20	The Data Science Process
28	Overview of the Data Science Process – Topics 1
30	Step-1: Defining Research Goals and Creating a Project Charter – Topics 2
33	Step-2: Retrieving Data – Topics 3
37	Step-3: Cleansing, integrating and Transforming Data – Topics 4
38	Step-4: Exploratory Data Analysis
41	Step-5: Build the Models – Topics 3
42	Step-6: Presenting Findings and Building Applications on top of Them
43	Summary
	Machine Learning
46	What is Machine Learning and Why Should You Care About It? – Topics 3
50	The Modeling Process – Topics 4
52	Types of Machine Learning – Topics 2
53	Semi-supervised Learning
54	Summary
	Handling Large Data on a Single Computer
55	The Problems You Face When Handling Large Data
58	General Techniques for Handling Large Volumes of Data – Topics 3
62	General Programming Tips for Dealing with Large Data Sets – Topics 4
66	Case Study-1: Predicting Malicious URLs – Topics 4
71	Case Study-2: Building a Recommender System Inside a Database – Topics 5
72	Summary
	First Steps in Big Data
74	Distributing Data Storage and Processing with Frameworks – Topics 2
79	Case Study: Assessing Risk When Loaning Money – Topics 5
80	Summary
	Join the NoSQL Movement
84	Introduction to NoSQL – 4
90	Case Study: What Disease is That? – 6
91	Summary
	The Rise of Graph Databases
92	Introducing Connected Data d Graph Databases – Topics 1
93	Introducing Neo4J: A Graph Database – Topics 1
99	Connected Data Example: A Recipe Recommendation Engine – Topics 6
100	Summary
	Text Mining and Text Analytics
101	Text Mining in the Real World
104	Text Mining Techniques – Topics 3
113	Case Study: Classifying Reddit Posts – Topics 9

114	Summary
	Data Visualization to the End User
115	Data Visualization Options
117	Cross-filter, The JavaScript MapReduce Library – Topics 2
118	Creating an Interactive Dashboard with Dc.js
119	Dashboard Development Tools
120	Summary

Data Science: Reference-2

	Data Science From Scratch: First Principles with Python
	Introduction
01	The Ascendance of Data
02	What is Data Science?
08	Motivating Hypothetical: DataSciencester – Topics 6
	A Crash Course in Python
22	The Basics – Topics 14
33	The Not-So-Basics – Topics 11
34	For Further Exploration
	Visualizing Data
35	matplotlib
36	Bar Charts
37	Line Charts
38	Scatterplots
39	For Further Exploration
	Linear Algebra
40	Vectors
41	Matrices
42	For Further Exploration
	Statistics
44	Describing a Single Set of Data – Topics 2
45	Correlation
46	Simpson's Paradox
47	Some Other Correlational Caveats
48	Correlation and Causation
49	For Further Exploration
	Probability
50	Dependency and Independency
51	Conditional Probability
52	Bayes's Theorem
53	Random Variables
54	Continuous Distributions
55	The Normal Distribution
56	The Central Limit Theorem
57	For Further Exploration
	Hypothesis and Inference
58	Statistical Hypothesis Testing
59	Example: Flipping a Coin
60	Confidence Intervals
61	P-hacking
62	Example: Running an A/B Test
63	Bayesian Inference
64	For Further Exploration
	Gradient Descent
65	The Idea Behind Gradient Descent
66	Estimating the Gradient
67	Using the Gradient
68	Choosing the Right Step Size

69	Putting It All Together
70	Stochastic Gradient Descent
71	For Further Exploration
<u>,                                    </u>	Getting Data
72	Stdin and stdout
74	Reading Files – Topics 2
76	Scraping the Web – Topics 2
79	Using APIs – Topics 3
81	Example: Using the Twitter APIs   Getting Credentials
82	For Further Exploration
	Working with Data
85	Exploring Your Data – Topics 3
86	Cleaning and Munging
87	Manipulating Data
88	Rescaling
89	Dimensionality Reduction
90	For Further Exploration
	Machine Learning
91	Modeling
92	What is Machine Learning?
93	Overfitting and Under-fitting
94	Correctness
95	The Bias-Variance Trade-off
96	Feature Extraction and Selection
97	For Further Exploration
	K-Nearest Neighbors
98	The Model
99	Example: Favorite Languages
100	The Curse of Dimensionality
101	For Further Exploration
	Naïve Bayes
102	A Really Dumb Spam Filter
103	A More Sophisticated Spam Filter
104	Implementation
105	Testing Our Model
106	For Further Exploration
	Simple Linear Regression
107	The Model
108	Using Gradient Descent
109	Maximum Likelihood Estimation
110	For Further Exploration
	Multiple Regression
111	The Model
112	Further Assumptions of the Least Squares Model
113	Fitting the Model
114	Interpreting the Model
115	Goodness of Fit
116	Digression: The Bootstrap
117	Standard Errors of Regression Coefficients
117 118 119	

	Logistic Regression
120	The Problem
121	The Logistic Function
122	Applying the Model
123	Goodness of Fit
124	Support Vector Machines
125	For Further Investigation
	Decision Trees
126	What is a Decision Tree?
127	Entropy
128	The Entropy of a Partition
129	Creating a Decision Tree
130	Putting It All Together
131	Random Forests
132	For Further Exploration
	Neural Networks
133	Perceptrons
134	Feed-Forward Neural Networks
135	Backpropagation
136	Example: Defeating a CAPTCHA
137	For Further Exploration
	Clustering
138	The Idea
139	The Model
140	Example: Meetups
141	Choosing K
142	Example: Clustering Colors
143	Bottom-up Hierarchical Clustering
144	For Further Exploration
	Natural Language Processing
145	World Clouds
146	n-gram Models
147	Grammars
148	An Aside: Gibbs Sampling
149	Topic Modeling
150	For Further Exploration
	Network Analysis
151	Betweenness Centrality
153	Eigenvector Centrality – Topics 2
154	Directed Graphs and PageRandk
155	For Further Exploration
	Recommender Systems
156	Manual Curation
157	Recommending What's Popular
158	User-Based Collaborative Filtering
159	Item-Based Collaborative Filtering
160	For Further Exploration
	Databases and SQL
161	CREATE TABLE and INSERT
162	UPDATE
163	DELETE
100	

164	SELECT
165	GOUP BY
166	ORDER BY
167	JOIN
168	Subqueries
169	Indexes
170	Query Optimization
171	NoSQL
172	For Further Exploration
	MapReduce
173	Example: Word Count
174	Why MapReduce
175	MapReduce More Generally
176	Example: Analyzing Status Updates
177	Example: Matrix Multiplication
178	An Aside: Combiners
179	For Further Exploration
	Go Forth and Do Data Science
180	IPython
181	Mathematics
186	Not from Scratch – Topics 5
187	Find Data
191	Do Data Science – Topics 4

### Data Warehouse and Mining

Data Warehouse and Mining: Reference-1

	Data Mining Concepts and Techniques
	Introduction
02	Why Data Mining? – Topics 2
03	What is Data Mining?
07	What Kinds of Data Can Be Mined? – Topics 4
13	What kinds of Patterns Can Be Mind? – Topics 6
17	Which Technologies Are Used? – Topics 4
19	Which Kinds of Applications Are Targeted? – Topics 2
24	Major Issues in Data Mining – Topics 5
25	Summary
	Exercises
	Bibliographic Nots
	Getting to Know Your Data
31	Data Objects and Attribute Types – Topics 6
34	Basic Statistical Descriptions of Data – Topics 3
39	Data Visualization – Topics 5
46	Measuring Data Similarity and Dissimilarity – Topics 7
47	Summary
	Exercises
	Bibliographic Notes
	Data Processing
49	Data Preprocessing: An Overview – Topics 2
52	Data Cleaning – Topics 3
56	Data Integration – Topics 4
65	Data Reduction – Topics 9
71	Data Transformation and Data Discretization – Topics 6
72	Summary
	Exercises
	Bibliographic Notes
	Data Warehousing and Online Analytical Processing
79	Data Warehouse: Basic Concepts – Topics 7
85	Data Warehouse Modeling: Data Cube and OLAP – Topics 6
89	Data Warehouse Design and Usage – Topics 4
93	Data Warehouse Implementation – Topics 4
96	Data Generalization by Attribute-Oriented Induction – Topics 3
97	Summary
	Exercises
	Bibliographic Notes
	Data Cube Technology
99	Data Cube Computation: Preliminary Concepts – Topics 2
103	Data Cube Computation Methods – Topics 4
105	Processing Advanced Kinds of Queries by Exploring Cube Technology – Topics 2
108	Multidimensional Data Analysis in Cube Space – Topics 3
109	Summary  Exercises
	Bibliographic Notes  Mining Fraguent Pottorns, Associations, and Correlations, Basic Concents and Mathods
	Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and Methods

111	Basic Concepts – Topics 2
117	Frequent Itemset Mining Methods – Topics 6
120	Which Patterns Are Interesting? – Pattern Evaluation Methods – Topics 3
121	Summary
	Exercises
	Bibliographic Notes
	Advanced Pattern Mining
122	Pattern Mining: A Road Map
126	Pattern Mining in Multilevel, Multidimensional Space – Topics 4
128	Constraint-Based Frequent Pattern Mining – Topics 2
129	Mining High-Dimensional Data and Colossal Patterns – Topics 1
131	Mining Compressed or Approximate Patterns – Topics 2
133	Pattern Exploration and Application – Topics 2
134	Summary
134	Exercises
	Bibliographic Notes
	Classification: Basic Concepts
136	Basic Concepts – Topics 2
141	Decision Tree Induction – Topics 5
143	Bayes Classification Methods – Topics 2
146	Rule-Based Classification – Topics 3
152	Model Evaluation and Selection – Topics 6
157	Techniques to Improve Classification Accuracy – Topics 5
158	Summary
130	Exercises
	Bibliographic Notes
	Classification: Advanced Methods
160	Bayesian Belief Networks – Topics 2
164	Classification by Backpropagation – Topics 4
166	Support Vector Machines – Topics 2
169	Classification Using Frequent Patterns – Topics 3
171	Lazy Learners (or Learning from Your Neighbors) – Topics 2
174	Other Classification Methods – Topics 3
178	Additional Topics Regarding Classification – Topics 4
179	Summary
173	Exercises
	Bibliographic Notes
	Cluster Analysis: Basic Concepts and Methods
182	Cluster Analysis – Topics 3
184	Partitioning Methods – Topics 2
189	Hierarchical Method – Topics 5
192	Density-Based Methods – Topics 3
194	Grid-Based Methods – Topics 2
197	Evaluation of Clustering – Topics 3
198	Summary Exercises
100	Bibliographic Notes
	Advanced Cluster Analysis
201	Probabilistic Model-Based Clustering – Topics 3
205	Clustering High-Dimensional Data – Topics 4
208	Clustering Graph and Network Data – Topics 3
210	Clustering with Constraints – Topics 2
	- Control of the cont

211	Summary
	Exercises
	Bibliographic Notes
	Outlier Detection
214	Outliers and Outlier Analysis – Topics 3
216	Outlier Detection Methods – Topics 2
218	Statistical Approaches – Topics 2
221	Proximity-Based Approaches – Topics 3
222	Clustering-Based Approaches
223	Classification-Based Approaches
226	Mining Contextual and Collective Outliers – Topics 3
229	Outlier Detection in High-Dimensional Data – Topics 3
230	Summary
	Exercises
	Bibliographic Notes
	Data Mining Trends and Research Frontiers
233	Mining Complex Data Types – Topics 3
236	Other Methodologies of Data Mining – Topics 3
241	Data mining Applications – Topics 5
243	Data Mining and Society – Topics 2
244	Data Mining Trends
245	Summary
	Exercises
	Bibliographic Notes

### Data Warehouse and Mining: Reference-2

Evolution of Decision Support Systems		Building the Data Warehouse
12 Problems with the Naturally Evolving Architecture – Topics 7 13 The Development Life Cycle 14 Patterns of Hardware Utilization 15 Setting the Stage for Re-Engineering 16 Monitoring the Data Warehouse Environment 17 Summary 18 The Data Warehouse Environment 18 The Structure of the Data Warehouse 19 Subject Orientation 20 Day 1 to Day n Phenomenon 23 Granularity – Topics 3 24 Exploration and Data Mining 25 Living Sample Database 27 Partitioning as a Design Approach   Partitioning of Data 28 Structuring Data in the Data Warehouse 29 Auditing and the Data Warehouse 20 Day Auditing and the Pata Warehouse 21 Purging Warehouse Data 22 Reporting and the Architected Environment 28 Structuring Data in the Data Warehouse 29 Auditing and the Architected Environment 30 Data Homogeneity and Heterogeneity 31 Purging Warehouse Data 32 Reporting and the Architected Environment 33 The Operational Window of Opportunity 4 Incorrect Data in the Data Warehouse 40 Summary 41 The Data Warehouse and Design 42 Beginning with Operational Data 41 The Data Warehouse and Data Models – Topics 3 42 Process and Data Models and the Architected Environment 43 Metadata – Topics 1 44 Cyclicity of Data – The Wrinkle of Time 45 Complexity of Transformation and Integration 46 Tipe Data Warehouse Record – Topics 3 47 Profile Records 48 Triggering the Data Warehouse Data 49 Profile Records 50 Managing Volume 51 Creating Multiple Profile Records 52 Going from the Data Warehouse Data 53 Supporting the ODS 54 Supporting the ODS 55 Supporting the ODS 56 Requirements and the Zachman Framework 57 Indirect Access of Data Warehouse Data 58 Start Joins 59 Supporting the Data Warehouse Data 59 Supporting the ODS 60 Requirements and the Zachman Framework 61 Summary 61 Granularity in the Data Warehouse		
Problems with the Naturally Evolving Architecture — Topics 7   The Development Life Cycle	05	
The Development Life Cycle		·
14 Patterns of Hardware Utilization 15 Setting the Stage for Re-Engineering 16 Monitoring the Data Warehouse Environment 17 Summary 18 The Structure of the Data Warehouse 19 Subject Orientation 20 Day 1 to Day n Phenomenon 21 Granularity – Topics 3 22 Granularity – Topics 3 23 Granularity – Topics 3 24 Exploration and Data Mining 25 Living Sample Database 27 Partitioning as a Design Approach   Partitioning of Data 28 Structuring Data in the Data Warehouse 29 Auditing and the Data Warehouse 20 Data Homogeneity and Heterogeneity 21 Purging Warehouse Data 22 Reporting and the Architected Environment 23 The Operational Window of Opportunity 24 Incorrect Data in the Data Warehouse 25 Summary 26 Beginning with Operational Data 27 Partitioning and Data in the Data Warehouse 28 Auditing and the Architected Environment 39 Process and Data Models and the Architected Environment 30 The Data Warehouse and Design 31 Incorrect Data in the Data Warehouse 32 Summary 33 The Data Models and the Architected Environment 40 The Data Marehouse and Data Models – Topics 3 41 The Data Model and Iterative Development 42 Normalization and De-normalization – Topics 1 43 Metadata – Topics 1 44 Cyclicity of Data – The Wrinkle of Time 45 Complexity of Transformation and Integration 46 Triggering the Data Warehouse Record – Topics 3 47 Profile Records 48 Triggering the Data Warehouse Record – Topics 3 49 Profile Records 50 Managing Volume 51 Creating Multiple Profile Records 52 Going from the Data Warehouse Data – Topics 3 53 Supporting the ODS 54 Start Joins 55 Supporting the ODS 56 Requirements and the Zachman Framework 57 Lummary 58 Supporting the ODS 58 Supporting the Data Warehouse Data		
15 Setting the Stage for Re-Engineering 16 Monitoring the Data Warehouse Environment 17 Summary 18 The Data Warehouse Environment 18 The Structure of the Data Warehouse 19 Subject Orientation 20 Day 1 to Day n Phenomenon 23 Granularity — Topics 3 24 Exploration and Data Mining 25 Living Sample Database 27 Partitioning as a Design Approach   Partitioning of Data 28 Structuring Data in the Data Warehouse 29 Auditing and the Data Warehouse 29 Auditing and the Data Warehouse 20 Data Homogeneity and Heterogeneity 30 Data Homogeneity and Heterogeneity 31 Purging Warehouse Data 32 Reporting and the Architected Environment 33 The Operational Window of Opportunity 34 Incorrect Data in the Data Warehouse 35 Summary 36 Beginning with Operational Data 37 Process and Data Models and the Architected Environment 40 The Data Warehouse and Data Models — Topics 3 41 The Data Warehouse and Data Models — Topics 3 41 The Data Warehouse and Data Models — Topics 1 42 Normalization and De-normalization — Topics 1 43 Metadata — Topics 1 44 Cyclicity of Data — The Wrinkle of Time 45 Complexity of Transformation and Integration 46 Triggering the Data Warehouse Record — Topics 3 47 Profile Records 48 Triggering the Data Warehouse Record — Topics 3 48 Triggering the Data Warehouse Record — Topics 3 49 Profile Records 50 Managing Volume 51 Creating Multiple Profile Records 52 Going from the Data Warehouse Data — Topics 3 53 Indirect Operational Access of Data Warehouse Data 54 Indirect Access of Data Warehouse Data 55 Supporting the ODS 66 Requirements and the Zachman Framework 67 Supmarity in the Data Warehouse		
16 Monitoring the Data Warehouse Environment 17 Summary The Data Warehouse Environment 18 The Structure of the Data Warehouse 19 Subject Orientation 20 Day 1 to Day n Phenomenon 21 Granularity – Topics 3 22 Exploration and Data Mining 23 Living Sample Database 26 Partitioning as a Design Approach   Partitioning of Data 27 Partitioning as a Design Approach   Partitioning of Data 28 Structuring Data in the Data Warehouse 29 Auditing and the Data Warehouse 30 Data Homogeneity and Heterogeneity 31 Purging Warehouse Data 32 Reporting and the Architected Environment 33 The Operational Window of Opportunity 34 Incorrect Data in the Data Warehouse 35 Summary The Data Warehouse and Design 36 Beginning with Operational Data 37 Process and Data Models and the Architected Environment 40 The Data Warehouse and Data Models and the Architected Environment 41 The Data Warehouse and Data Models and the Architected Environment 42 Normalization and De-normalization – Topics 3 43 Metadata – Topics 1 44 Cyclicity of Data — The Wrinkle of Time 45 Complexity of Transformation and Integration 48 Triggering the Data Warehouse Record – Topics 3 49 Profile Records 50 Managing Volume 51 Creating Multiple Profile Records 52 Going from the Data Warehouse Data – Topics 3 53 Indirect Use of Data Warehouse Data 54 Indirect Access of Data Warehouse Data 55 Indirect Use of Data Warehouse Data 56 Indirect Access of Data Warehouse Data 57 Indirect Use of Data Warehouse Data 58 Start Joins 59 Supporting the ODS 60 Requirements and the Zachman Framework 61 Summary 61 Granularity in the Data Warehouse		
The Data Warehouse Environment  The Structure of the Data Warehouse  19 Subject Orientation  20 Day 1 to Day n Phenomenon  31 Granularity – Topics 3  22 Exploration and Data Mining  25 Living Sample Database  27 Partitioning as a Design Approach   Partitioning of Data  28 Structuring Data in the Data Warehouse  29 Auditing and the Data Warehouse  30 Data Homogeneity and Heterogeneity  31 Purging Warehouse Data  32 Reporting and the Architected Environment  33 The Operational Window of Opportunity  34 Incorrect Data in the Data Warehouse  35 Summary  The Data Warehouse and Design  36 Beginning with Operational Data  37 Process and Data Models and the Architected Environment  40 The Data Warehouse and Data Models – Topics 3  41 The Data Warehouse and Data Models – Topics 3  41 The Data Model and Iterative Development  42 Normalization and De-normalization – Topics 1  43 Metadata – Topics 1  44 Cyclicity of Data – The Wrinkle of Time  45 Complexity of Transformation and Integration  48 Triggering the Data Warehouse Record – Topics 3  49 Profile Records  50 Managing Volume  51 Creating Multiple Profile Records  52 Going from the Data Warehouse Data  53 Indirect Access of Data Warehouse Data  54 Indirect Use of Data Warehouse Data  55 Indirect Use of Data Warehouse Data  56 Indirect Access of Data Warehouse Data  57 Indirect Use of Data Warehouse Data  58 Start Joins  59 Supporting the ODS  60 Requirements and the Zachman Framework  61 Summary  Granularity in the Data Warehouse		
The Data Warehouse Environment  The Structure of the Data Warehouse  Subject Orientation  Day 1 to Day n Phenomenon  Granularity – Topics 3  Exploration and Data Mining  Living Sample Database  Partitioning as a Design Approach   Partitioning of Data  Structuring Data in the Data Warehouse  Auditing and the Data Warehouse  Auditing and the Data Warehouse  Purging Warehouse Data  Reporting and the Architected Environment  The Operational Window of Opportunity  Incorrect Data in the Data Warehouse  Beginning with Operational Data  Process and Data Models and the Architected Environment  The Data Warehouse and Design  Beginning with Operational Data  Process and Data Models and the Architected Environment  The Data Warehouse and Data Models – Topics 3  The Data Warehouse and Data Models – Topics 1  Metadata – Topics 1  Cyclicity of Data – The Wrinkle of Time  Cyclicity of Data – The Wrinkle of Time  Complexity of Transformation and Integration  Triggering the Data Warehouse Record – Topics 3  Profile Records  Managing Volume  Triggering the Data Warehouse Necord – Topics 3  Profile Records  Managing Volume  Triggering the Data Warehouse to the Operational Environment  Direct Operational Access of Data Warehouse Data – Topics 3  Indirect Use of Data Warehouse Data – Topics 3  Indirect Use of Data Warehouse Data – Topics 3  Supporting the ODS  Requirements and the Zachman Framework  Supmary  Granularity in the Data Warehouse		
18 The Structure of the Data Warehouse 19 Subject Orientation 20 Day 1 to Day n Phenomenon 23 Granularity – Topics 3 24 Exploration and Data Mining 25 Living Sample Database 27 Partitioning as a Design Approach   Partitioning of Data 28 Structuring Data in the Data Warehouse 29 Auditing and the Data Warehouse 30 Data Homogeneity and Heterogeneity 31 Purging Warehouse Data 32 Reporting and the Architected Environment 33 The Operational Window of Opportunity 34 Incorrect Data in the Data Warehouse 35 Summary  The Data Warehouse and Design 36 Beginning with Operational Data 37 Process and Data Models and the Architected Environment 40 The Data Warehouse and Data Models – Topics 3 41 The Data Warehouse and Data Models – Topics 3 42 Normalization and De-normalization – Topics 1 43 Metadata – Topics 1 44 Cyclicity of Data – The Wrinkle of Time 45 Complexity of Transformation and Integration 48 Triggering the Data Warehouse Record – Topics 3 49 Profile Records 50 Managing Volume 51 Creating Multiple Profile Records 52 Going from the Data Warehouse Data – Topics 3 53 Indirect Use of Data Warehouse Data 54 Indirect Access of Data Warehouse Data – Topics 3 55 Start Joins 56 Supmary 57 Indirect Operational Access of Data Warehouse Data	1/	,
19 Subject Orientation 20 Day 1 to Day n Phenomenon 23 Granularity – Topics 3 24 Exploration and Data Mining 25 Living Sample Database 27 Partitioning as a Design Approach   Partitioning of Data 28 Structuring Data in the Data Warehouse 29 Auditing and the Data Warehouse 30 Data Homogeneity and Heterogeneity 31 Purging Warehouse Data 32 Reporting and the Architected Environment 33 The Operational Window of Opportunity 34 Incorrect Data in the Data Warehouse 35 Summary 36 Beginning with Operational Data 37 Process and Data Models and the Architected Environment 40 The Data Warehouse and Data Models – Topics 3 41 The Data Marehouse and Data Models – Topics 3 42 Normalization and De-normalization – Topics 1 43 Metadata – Topics 1 44 Cyclicity of Data – The Wrinkle of Time 45 Complexity of Transformation and Integration 48 Triggering the Data Warehouse Record – Topics 3 49 Profile Records 50 Managing Volume 51 Creating Multiple Profile Records 50 Going from the Data Warehouse Data 57 Indirect Use of Data Warehouse Data 58 Start Joins 59 Supporting the ODS 60 Requirements and the Zachman Framework 61 Summary 6 Granularity in the Data Warehouse	10	
20 Day 1 to Day n Phenomenon 23 Granularity - Topics 3 24 Exploration and Data Mining 25 Living Sample Database 27 Partitioning as a Design Approach   Partitioning of Data 28 Structuring Data in the Data Warehouse 29 Auditing and the Data Warehouse 30 Data Homogeneity and Heterogeneity 31 Purging Warehouse Data 32 Reporting and the Architected Environment 33 The Operational Window of Opportunity 34 Incorrect Data in the Data Warehouse 35 Summary  The Data Warehouse and Design 36 Beginning with Operational Data 37 Process and Data Models and the Architected Environment 40 The Data Warehouse and Data Models - Topics 3 41 The Data Model and Iterative Development 42 Normalization and De-normalization - Topics 1 43 Metadata - Topics 1 44 Cyclicity of Data - The Wrinkle of Time 45 Complexity of Transformation and Integration 48 Triggering the Data Warehouse Record - Topics 3 49 Profile Records 50 Managing Volume 51 Creating Multiple Profile Records 52 Going from the Data Warehouse Data 53 Start Joins 54 Start Joins 55 Supporting the ODS 60 Requirements and the Zachman Framework 61 Summary  Granularity in the Data Warehouse		
23 Granularity – Topics 3 24 Exploration and Data Mining 25 Living Sample Database 27 Partitioning as a Design Approach   Partitioning of Data 28 Structuring Data in the Data Warehouse 29 Auditing and the Data Warehouse 30 Data Homogeneity and Heterogeneity 31 Purging Warehouse Data 32 Reporting and the Architected Environment 33 The Operational Window of Opportunity 34 Incorrect Data in the Data Warehouse 35 Summary		
24 Exploration and Data Mining 25 Living Sample Database 27 Partitioning as a Design Approach   Partitioning of Data 28 Structuring Data in the Data Warehouse 29 Auditing and the Data Warehouse 30 Data Homogeneity and Heterogeneity 31 Purging Warehouse Data 32 Reporting and the Architected Environment 33 The Operational Window of Opportunity 34 Incorrect Data in the Data Warehouse 35 Summary  The Data Warehouse and Design 36 Beginning with Operational Data 37 Process and Data Models and the Architected Environment 40 The Data Warehouse and Data Models – Topics 3 41 The Data Worehouse and Data Models – Topics 1 42 Normalization and De-normalization – Topics 1 43 Metadata – Topics 1 44 Cyclicity of Data – The Wrinkle of Time 45 Complexity of Transformation and Integration 48 Triggering the Data Warehouse Record – Topics 3 49 Profile Records 50 Managing Volume 51 Creating Multiple Profile Records 52 Going from the Data Warehouse to the Operational Environment 53 Direct Operational Access of Data Warehouse Data 56 Indirect Use of Data Warehouse Data 57 Indirect Use of Data Warehouse Data 58 Start Joins 59 Supporting the ODS 60 Requirements and the Zachman Framework 61 Summary 6 Granularity in the Data Warehouse		
25 Living Sample Database 27 Partitioning as a Design Approach   Partitioning of Data 28 Structuring Data in the Data Warehouse 29 Auditing and the Data Warehouse 30 Data Homogeneity and Heterogeneity 31 Purging Warehouse Data 32 Reporting and the Architected Environment 33 The Operational Window of Opportunity 34 Incorrect Data in the Data Warehouse 35 Summary  The Data Warehouse and Design 36 Beginning with Operational Data 37 Process and Data Models and the Architected Environment 40 The Data Warehouse and Data Models – Topics 3 41 The Data Warehouse and Data Models – Topics 1 42 Normalization and De-normalization – Topics 1 43 Metadata – Topics 1 44 Cyclicity of Data – The Wrinkle of Time 45 Complexity of Transformation and Integration 48 Triggering the Data Warehouse Record – Topics 3 49 Profile Records 50 Managing Volume 51 Creating Multiple Profile Records 52 Going from the Data Warehouse to the Operational Environment 53 Direct Operational Access of Data Warehouse Data 56 Indirect Use of Data Warehouse Data 57 Indirect Use of Data Warehouse Data 58 Start Joins 59 Supporting the ODS 60 Requirements and the Zachman Framework 61 Summary 6 Granularity in the Data Warehouse		
27 Partitioning as a Design Approach   Partitioning of Data 28 Structuring Data in the Data Warehouse 29 Auditing and the Data Warehouse 30 Data Homogeneity and Heterogeneity 31 Purging Warehouse Data 32 Reporting and the Architected Environment 33 The Operational Window of Opportunity 34 Incorrect Data in the Data Warehouse 35 Summary  The Data Warehouse and Design 36 Beginning with Operational Data 37 Process and Data Models and the Architected Environment 40 The Data Warehouse and Data Models – Topics 3 41 The Data Warehouse and Data Models – Topics 3 42 Normalization and De-normalization – Topics 1 43 Metadta – Topics 1 44 Cyclicity of Data – The Wrinkle of Time 45 Complexity of Transformation and Integration 48 Triggering the Data Warehouse Record – Topics 3 49 Profile Records 50 Managing Volume 51 Creating Multiple Profile Records 52 Going from the Data Warehouse to the Operational Environment 53 Direct Operational Access of Data Warehouse Data 56 Indirect Use of Data Warehouse Data 57 Indirect Use of Data Warehouse Data 58 Start Joins 59 Supporting the ODS 60 Requirements and the Zachman Framework 61 Summary 6 Granularity in the Data Warehouse		
28 Structuring Data in the Data Warehouse 29 Auditing and the Data Warehouse 30 Data Homogeneity and Heterogeneity 31 Purging Warehouse Data 32 Reporting and the Architected Environment 33 The Operational Window of Opportunity 34 Incorrect Data in the Data Warehouse 35 Summary  The Data Warehouse and Design 36 Beginning with Operational Data 37 Process and Data Models and the Architected Environment 40 The Data Warehouse and Data Models – Topics 3 41 The Data Warehouse and Data Models – Topics 3 42 Normalization and De-normalization – Topics 1 43 Metadata – Topics 1 44 Cyclicity of Data – The Wrinkle of Time 45 Complexity of Transformation and Integration 48 Triggering the Data Warehouse Record – Topics 3 49 Profile Records 50 Managing Volume 51 Creating Multiple Profile Records 52 Going from the Data Warehouse to the Operational Environment 53 Direct Operational Access of Data Warehouse Data 56 Indirect Access of Data Warehouse Data 57 Indirect Use of Data Warehouse Data 58 Start Joins 59 Supporting the ODS 60 Requirements and the Zachman Framework 61 Summary 6 Granularity in the Data Warehouse		
29 Auditing and the Data Warehouse 30 Data Homogeneity and Heterogeneity 31 Purging Warehouse Data 32 Reporting and the Architected Environment 33 The Operational Window of Opportunity 34 Incorrect Data in the Data Warehouse 35 Summary  The Data Warehouse and Design 36 Beginning with Operational Data 37 Process and Data Models and the Architected Environment 40 The Data Warehouse and Data Models – Topics 3 41 The Data Warehouse and Data Models – Topics 3 42 Normalization and De-normalization – Topics 1 43 Metadata – Topics 1 44 Cyclicity of Data – The Wrinkle of Time 45 Complexity of Transformation and Integration 48 Triggering the Data Warehouse Record – Topics 3 49 Profile Records 50 Managing Volume 51 Creating Multiple Profile Records 52 Going from the Data Warehouse to the Operational Environment 53 Direct Operational Access of Data Warehouse Data 56 Indirect Use of Data Warehouse Data 57 Indirect Use of Data Warehouse Data 58 Start Joins 59 Supporting the ODS 60 Requirements and the Zachman Framework 61 Summary  Granularity in the Data Warehouse		
30 Data Homogeneity and Heterogeneity 31 Purging Warehouse Data 32 Reporting and the Architected Environment 33 The Operational Window of Opportunity 34 Incorrect Data in the Data Warehouse 35 Summary  The Data Warehouse and Design 36 Beginning with Operational Data 37 Process and Data Models and the Architected Environment 40 The Data Warehouse and Data Models – Topics 3 41 The Data Warehouse and Data Models – Topics 3 41 The Data Model and Iterative Development 42 Normalization and De-normalization – Topics 1 43 Metadata – Topics 1 44 Cyclicity of Data – The Wrinkle of Time 45 Complexity of Transformation and Integration 48 Triggering the Data Warehouse Record – Topics 3 49 Profile Records 50 Managing Volume 51 Creating Multiple Profile Records 52 Going from the Data Warehouse to the Operational Environment 53 Direct Operational Access of Data Warehouse Data 56 Indirect Access of Data Warehouse Data – Topics 3 57 Indirect Use of Data Warehouse Data 58 Start Joins 59 Supporting the ODS 60 Requirements and the Zachman Framework 61 Summary  Granularity in the Data Warehouse		
31 Purging Warehouse Data 32 Reporting and the Architected Environment 33 The Operational Window of Opportunity 34 Incorrect Data in the Data Warehouse 35 Summary  The Data Warehouse and Design 36 Beginning with Operational Data 37 Process and Data Models and the Architected Environment 40 The Data Warehouse and Data Models – Topics 3 41 The Data Warehouse and Data Models – Topics 3 42 Normalization and De-normalization – Topics 1 43 Metadata – Topics 1 44 Cyclicity of Data – The Wrinkle of Time 45 Complexity of Transformation and Integration 48 Triggering the Data Warehouse Record – Topics 3 49 Profile Records 50 Managing Volume 51 Creating Multiple Profile Records 52 Going from the Data Warehouse to the Operational Environment 53 Direct Operational Access of Data Warehouse Data 56 Indirect Access of Data Warehouse Data – Topics 3 57 Indirect Use of Data Warehouse Data 58 Start Joins 59 Supporting the ODS 60 Requirements and the Zachman Framework 61 Summary 6ranularity in the Data Warehouse		
32 Reporting and the Architected Environment 33 The Operational Window of Opportunity 34 Incorrect Data in the Data Warehouse 35 Summary  The Data Warehouse and Design 36 Beginning with Operational Data 37 Process and Data Models and the Architected Environment 40 The Data Warehouse and Data Models – Topics 3 41 The Data Model and Iterative Development 42 Normalization and De-normalization – Topics 1 43 Metadata – Topics 1 44 Cyclicity of Data – The Wrinkle of Time 45 Complexity of Transformation and Integration 48 Triggering the Data Warehouse Record – Topics 3 49 Profile Records 50 Managing Volume 51 Creating Multiple Profile Records 52 Going from the Data Warehouse to the Operational Environment 53 Direct Operational Access of Data Warehouse Data 56 Indirect Access of Data Warehouse Data 57 Indirect Use of Data Warehouse Data 58 Start Joins 59 Supporting the ODS 60 Requirements and the Zachman Framework 61 Summary 6 Granularity in the Data Warehouse		
The Operational Window of Opportunity Incorrect Data in the Data Warehouse Summary The Data Warehouse and Design Beginning with Operational Data The Data Warehouse and Data Models and the Architected Environment The Data Warehouse and Data Models – Topics 3 The Data Warehouse and Data Models – Topics 3  The Data Model and Iterative Development Normalization and De-normalization – Topics 1  Metadata – Topics 1  Cyclicity of Data – The Wrinkle of Time Complexity of Transformation and Integration Triggering the Data Warehouse Record – Topics 3 Profile Records Managing Volume Creating Multiple Profile Records Going from the Data Warehouse to the Operational Environment Direct Operational Access of Data Warehouse Data Indirect Access of Data Warehouse Data Start Joins Supporting the ODS Requirements and the Zachman Framework Granularity in the Data Warehouse Granularity in the Data Warehouse		
Incorrect Data in the Data Warehouse		
The Data Warehouse and Design  Beginning with Operational Data  Process and Data Models and the Architected Environment  The Data Warehouse and Data Models – Topics 3  The Data Model and Iterative Development  Normalization and De-normalization – Topics 1  Metadata – Topics 1  Cyclicity of Data – The Wrinkle of Time  Complexity of Transformation and Integration  Triggering the Data Warehouse Record – Topics 3  Profile Records  Managing Volume  Creating Multiple Profile Records  Going from the Data Warehouse to the Operational Environment  Direct Operational Access of Data Warehouse Data  Indirect Access of Data Warehouse Data – Topics 3  Start Joins  Supporting the ODS  Requirements and the Zachman Framework  Summary  Granularity in the Data Warehouse		
The Data Warehouse and Design  Beginning with Operational Data  Process and Data Models and the Architected Environment  The Data Warehouse and Data Models – Topics 3  The Data Warehouse and Data Models – Topics 3  The Data Model and Iterative Development  Normalization and De-normalization – Topics 1  Metadata – Topics 1  Cyclicity of Data – The Wrinkle of Time  Complexity of Transformation and Integration  Triggering the Data Warehouse Record – Topics 3  Profile Records  Managing Volume  Creating Multiple Profile Records  Going from the Data Warehouse to the Operational Environment  Mirect Operational Access of Data Warehouse Data  Indirect Access of Data Warehouse Data – Topics 3  Indirect Use of Data Warehouse Data  Start Joins  Supporting the ODS  Requirements and the Zachman Framework  Summary  Granularity in the Data Warehouse		
36 Beginning with Operational Data 37 Process and Data Models and the Architected Environment 40 The Data Warehouse and Data Models – Topics 3 41 The Data Model and Iterative Development 42 Normalization and De-normalization – Topics 1 43 Metadata – Topics 1 44 Cyclicity of Data – The Wrinkle of Time 45 Complexity of Transformation and Integration 48 Triggering the Data Warehouse Record – Topics 3 49 Profile Records 50 Managing Volume 51 Creating Multiple Profile Records 52 Going from the Data Warehouse to the Operational Environment 53 Direct Operational Access of Data Warehouse Data 56 Indirect Access of Data Warehouse Data – Topics 3 57 Indirect Use of Data Warehouse Data 58 Start Joins 59 Supporting the ODS 60 Requirements and the Zachman Framework 61 Summary 6 Granularity in the Data Warehouse	35	
37Process and Data Models and the Architected Environment40The Data Warehouse and Data Models – Topics 341The Data Model and Iterative Development42Normalization and De-normalization – Topics 143Metadata – Topics 144Cyclicity of Data – The Wrinkle of Time45Complexity of Transformation and Integration48Triggering the Data Warehouse Record – Topics 349Profile Records50Managing Volume51Creating Multiple Profile Records52Going from the Data Warehouse to the Operational Environment53Direct Operational Access of Data Warehouse Data56Indirect Access of Data Warehouse Data – Topics 357Indirect Use of Data Warehouse Data58Start Joins59Supporting the ODS60Requirements and the Zachman Framework61SummaryGranularity in the Data Warehouse		
40 The Data Warehouse and Data Models – Topics 3 41 The Data Model and Iterative Development 42 Normalization and De-normalization – Topics 1 43 Metadata – Topics 1 44 Cyclicity of Data – The Wrinkle of Time 45 Complexity of Transformation and Integration 48 Triggering the Data Warehouse Record – Topics 3 49 Profile Records 50 Managing Volume 51 Creating Multiple Profile Records 52 Going from the Data Warehouse to the Operational Environment 53 Direct Operational Access of Data Warehouse Data 56 Indirect Access of Data Warehouse Data – Topics 3 57 Indirect Use of Data Warehouse Data 58 Start Joins 59 Supporting the ODS 60 Requirements and the Zachman Framework 61 Summary  Granularity in the Data Warehouse		
41 The Data Model and Iterative Development 42 Normalization and De-normalization – Topics 1 43 Metadata – Topics 1 44 Cyclicity of Data – The Wrinkle of Time 45 Complexity of Transformation and Integration 48 Triggering the Data Warehouse Record – Topics 3 49 Profile Records 50 Managing Volume 51 Creating Multiple Profile Records 52 Going from the Data Warehouse to the Operational Environment 53 Direct Operational Access of Data Warehouse Data 56 Indirect Access of Data Warehouse Data – Topics 3 57 Indirect Use of Data Warehouse Data 58 Start Joins 59 Supporting the ODS 60 Requirements and the Zachman Framework 61 Summary  Granularity in the Data Warehouse		
42Normalization and De-normalization – Topics 143Metadata – Topics 144Cyclicity of Data – The Wrinkle of Time45Complexity of Transformation and Integration48Triggering the Data Warehouse Record – Topics 349Profile Records50Managing Volume51Creating Multiple Profile Records52Going from the Data Warehouse to the Operational Environment53Direct Operational Access of Data Warehouse Data56Indirect Access of Data Warehouse Data – Topics 357Indirect Use of Data Warehouse Data58Start Joins59Supporting the ODS60Requirements and the Zachman Framework61SummaryGranularity in the Data Warehouse		
43 Metadata – Topics 1 44 Cyclicity of Data – The Wrinkle of Time 45 Complexity of Transformation and Integration 48 Triggering the Data Warehouse Record – Topics 3 49 Profile Records 50 Managing Volume 51 Creating Multiple Profile Records 52 Going from the Data Warehouse to the Operational Environment 53 Direct Operational Access of Data Warehouse Data 56 Indirect Access of Data Warehouse Data – Topics 3 57 Indirect Use of Data Warehouse Data 58 Start Joins 59 Supporting the ODS 60 Requirements and the Zachman Framework 61 Summary Granularity in the Data Warehouse		·
44 Cyclicity of Data – The Wrinkle of Time 45 Complexity of Transformation and Integration 48 Triggering the Data Warehouse Record – Topics 3 49 Profile Records 50 Managing Volume 51 Creating Multiple Profile Records 52 Going from the Data Warehouse to the Operational Environment 53 Direct Operational Access of Data Warehouse Data 56 Indirect Access of Data Warehouse Data – Topics 3 57 Indirect Use of Data Warehouse Data 58 Start Joins 59 Supporting the ODS 60 Requirements and the Zachman Framework 61 Summary 6 Granularity in the Data Warehouse		,
45 Complexity of Transformation and Integration 48 Triggering the Data Warehouse Record – Topics 3 49 Profile Records 50 Managing Volume 51 Creating Multiple Profile Records 52 Going from the Data Warehouse to the Operational Environment 53 Direct Operational Access of Data Warehouse Data 56 Indirect Access of Data Warehouse Data – Topics 3 57 Indirect Use of Data Warehouse Data 58 Start Joins 59 Supporting the ODS 60 Requirements and the Zachman Framework 61 Summary  Granularity in the Data Warehouse		
Triggering the Data Warehouse Record – Topics 3  49 Profile Records  50 Managing Volume  51 Creating Multiple Profile Records  52 Going from the Data Warehouse to the Operational Environment  53 Direct Operational Access of Data Warehouse Data  56 Indirect Access of Data Warehouse Data – Topics 3  57 Indirect Use of Data Warehouse Data  58 Start Joins  59 Supporting the ODS  60 Requirements and the Zachman Framework  61 Summary  Granularity in the Data Warehouse		
Profile Records  Managing Volume  Creating Multiple Profile Records  Going from the Data Warehouse to the Operational Environment  Indirect Operational Access of Data Warehouse Data  Indirect Access of Data Warehouse Data — Topics 3  Indirect Use of Data Warehouse Data  Start Joins  Supporting the ODS  Requirements and the Zachman Framework  Summary  Granularity in the Data Warehouse		
50 Managing Volume 51 Creating Multiple Profile Records 52 Going from the Data Warehouse to the Operational Environment 53 Direct Operational Access of Data Warehouse Data 56 Indirect Access of Data Warehouse Data — Topics 3 57 Indirect Use of Data Warehouse Data 58 Start Joins 59 Supporting the ODS 60 Requirements and the Zachman Framework 61 Summary  Granularity in the Data Warehouse		
51 Creating Multiple Profile Records 52 Going from the Data Warehouse to the Operational Environment 53 Direct Operational Access of Data Warehouse Data 56 Indirect Access of Data Warehouse Data – Topics 3 57 Indirect Use of Data Warehouse Data 58 Start Joins 59 Supporting the ODS 60 Requirements and the Zachman Framework 61 Summary  Granularity in the Data Warehouse		
Going from the Data Warehouse to the Operational Environment  Direct Operational Access of Data Warehouse Data  Indirect Access of Data Warehouse Data – Topics 3  Indirect Use of Data Warehouse Data  Start Joins  Supporting the ODS  Requirements and the Zachman Framework  Summary  Granularity in the Data Warehouse		
53 Direct Operational Access of Data Warehouse Data 56 Indirect Access of Data Warehouse Data – Topics 3 57 Indirect Use of Data Warehouse Data 58 Start Joins 59 Supporting the ODS 60 Requirements and the Zachman Framework 61 Summary Granularity in the Data Warehouse		
56 Indirect Access of Data Warehouse Data – Topics 3 57 Indirect Use of Data Warehouse Data 58 Start Joins 59 Supporting the ODS 60 Requirements and the Zachman Framework 61 Summary Granularity in the Data Warehouse		
57 Indirect Use of Data Warehouse Data 58 Start Joins 59 Supporting the ODS 60 Requirements and the Zachman Framework 61 Summary Granularity in the Data Warehouse		
58 Start Joins 59 Supporting the ODS 60 Requirements and the Zachman Framework 61 Summary Granularity in the Data Warehouse		·
59 Supporting the ODS 60 Requirements and the Zachman Framework 61 Summary Granularity in the Data Warehouse		Indirect Use of Data Warehouse Data
60 Requirements and the Zachman Framework 61 Summary Granularity in the Data Warehouse		
61 Summary  Granularity in the Data Warehouse		Supporting the ODS
Granularity in the Data Warehouse		Requirements and the Zachman Framework
	61	·
62 Managing Large Amounts of Data		Granularity in the Data Warehouse
	62	Managing Large Amounts of Data

63	Managing Multiple Media
64	Indexing and Monitoring Data
65	Interfaces of Many Technologies
66	Programmer or Designer Control of Data Placement
68	Parallel Storage and Management of Data   Metadata Management
69	Language Interface
70	Efficient Loading of Data
71	Efficient Index Utilization
72	Compaction of Data
73	Compound Keys
74	Variable-Length Data
75	Lock Management
76	Index-Only Processing
77	Fast Restore
78	Other Technological Features
79	DBMS Types and the Data Warehouse
80	Changing DBMS Technology
81	Multidimensional DBMS and the Data Warehouse
82	Data Warehousing Across Multiple Storage Media
83	The Role of Metadata in the Data Warehouse Environment
86	Context and Content – Topics 3
87	Refreshing the Data Warehouse
88	Testing
89	Summary
	The Distributed Data Warehouse
97	Types of Distributed Data Warehouses – Topics 8
98	The Nature of the Development Efforts – Topics 1
101	Distributed Data Warehouse Development – Topics 3
102	Building the Warehouse on Multiple Levels
105	Multiple Groups Building the Current Level of Detail – Topics 3
106	Multiple Platforms for Common Detail Data
107	Summary
	Executive Information Systems and the Data Warehouse
108	EIS – The Promise
109	A Simple Example
110	Drill-Down Analysis
111	Supporting the Drill-Down Process
112	The Data Warehouse as a Basis for EIS
113	Where to Turn
114	Event Mapping
115	Detailed Data and EIS
116	Keeping Only Summary Data in the EIS
117	Summary
446	External Data and the Data Warehouse
118	External Data in the Data Warehouse
119	Metadata and External Data
120	Storing External Data
121	Different Components of External Data
122	Modeling and External Data
123	Secondary Reports
124	Archiving External Data

125	Comparing Internal Data to External Data
126	Summary
120	Migration to the Architected Environment
127	A Migration Plan
128	The Feedback Loop
129	Strategic Considerations
130	Methodology and Migration
133	A Data-Driven Development Methodology – Topics 3
134	Summary
134	The Data Warehouse and the Web
135	Supporting the e-Business Environment
136	Moving Data from the Web to the Data Warehouse
137	Moving Data from the Data Warehouse of the Web
138	Web Support
139	Summary
139	Unstructured Data and the Data Warehouse
1//	
144	Integrating the Two Worlds – Topics 5
148	A Themed Match – Topics 4
151	A Two-Tiered Data Warehouse – Topics 3
153	A Self-Organizing Map (SOM) – Topics 2
154	Fitting the Two Environments Together
155	Summary
456	The Really Large Data Warehouse
156	Why The Rapid Growth?
163	The Impact of Large Volumes of Data – Topics 7
167	Disk Storage in the Face of Data Separation – Topics 4
171	Moving Data from One Environment to Another – Topics 4
172	Inverting the Data Warehouse
173	Total Cost
174	Maximum Capacity
175	Summary
	The Relational and the Multidimensional Models as a Basis for Database Design
176	The Relational Model
177	The Multidimensional Model
178	Snowflake Structures
183	Differences Between the Models – Topics 5
184	Independent Data Marts
185	Building Independent Data Marts
186	Summary
	Data Warehouse Advanced Topics
189	End-User Requirements and the Data Warehouse – Topics 3
193	Resource Contention in the Data Warehouse – Topics 4
194	Data Marts and Data Warehouses in the Same Processor
195	The Life Cycle of Data – Topics 1
196	Testing and the Data Warehouse
198	Tracing the Flow of Data Through the Data Warehouse – Topics 2
202	Data Warehouse and the Web-Based e-Business Environment – Topics 4
203	The Financial Data Warehouse
204	The System of Record
206	A Brief History of Architecture – Evolving to the Corporate Information Factory – Topics 2
210	CIF – Into the Future – Topics 4

211	Summary
	Cost-Justification and Return on Investment for a Data Warehouse
212	Copying the Competition
213	The Macro Level of Cost-Justification
214	A Micro Level Cost-Justification
220	Information from the Legacy Environment – Topics 6
222	The Time Value of Data   The Speed of Information
224	Integrated Information – Topics 2
225	Summary
	The Data Warehouse and the ODS
228	Complementary Structures – Topics 3
229	Different Classes of ODS
230	Database Design – A Hybrid Approach
231	Drawn to Proportion
232	Transaction Integrity in the ODS
233	Time Slicing the ODS Day
234	Multiple ODS
235	ODS and the Web Environment
236	An Example of an ODS
237	Summary
	Corporate Information Compliance and Data Warehousing
238	The Basic Activities
240	Financial Compliance – Topics 2
241	Auditing Corporate Communications
242	Summary
	The End-User Community
243	The Farmer
244	The Explorer
245	The Miner
246	The Tourist
247	The Community
248	Different Types of Data
249	Cost-Justification and ROI Analysis
250	Summary
	Data Warehouse Design Review Checklist
251	When to Do a Design Review
252	Who Should Be in the Design Review?
253	What Should the Agenda Be?
254	The Results
255	Administering the Review
256	A Typical Data Warehouse Design Review
257	Summary