Core Programming

Core Programming: Reference-1

	Durante manifestic C. A Consulate later destrict to the C. Durante manifest language
	Programming in C – A Complete Introduction to the C Programming Language
04	Introduction and Some Fundamentals
01	Programming
02	Higher-Level Languages
03	Integrated Development Environments
04	Operating System
05	Compiling Programs
06	Integrated Development Environment
07	Language Interpreters
	Compiling and Running Your First Program
08	Compiling Your Program
09	Running Your Program
10	Understanding Your First Program
11	Displaying the Values of Variables
12	Comments
	Exercises
	Variables, Data Types, and Arithmetic Expressions
13	Working with Variables
19	Understanding Data Types and Constants – Topics 6
22	Working with Arithmetic Expression – Topics 3
23	The Assignment Operators
24	Types _Complex and _Imaginary
	Program Looping
29	The (for) Statement – Topics 5
30	The (While) Statement
32	The (do) Statement – Topics 2
	Making Decisions
36	The (if) Statement – Topics 4
37	The (switch) Statement
38	Boolean Variables
39	The Conditional Operators
	Exercises
	Working with Arrays
42	Defining an Array – Topics 3
43	Initializing Arrays
45	Character Arrays – Topics 2
46	Multidimensional Arrays
47	Variable-Length Arrays
	Exercises
	Working with Functions
48	Defining a Function
50	Arguments and Local Variables – Topics 2
51	Returning Function Results
53	Functions Calling Functions Calling – Topics 2
54	Top-Down Programming
57	Functions and Arrays – Topics 3
58	Global Variables
59	Automatic and Static Variables
60	Recursive Functions
	1

	Exercises
	Working with Structures
62	A Structure for Storing the Date – Topics 1
64	Functions and Structures – Topics 1
66	Initializing Structures – Topics 1
67	Arrays of Structures
68	Structures Containing Structures
69	Structures Containing Arrays
70	Structure Variants
70	Exercises
	Character Strings
71	Arrays of Characters
76	Variable-Length Character Strings – Topics 5
77	Escape Characters
78	More on Constant Strings
80	Character Strings, Structures, and Arrays – Topics 1
81	Character Operations
01	Exercises
	Pointers
82	Defining a Pointer Variable
83	Using Pointers in Expressions
85	Working with Pointers and Structures – Topics 2
86	The Keyword (Const) and Pointers
87	Pointers and Functions
92	Pointers and Arrays – Topics 5
93	Operations on Pointers
94	Pointers to Functions
95	Pointers and Memory Addresses
93	Exercises
	Operations on Bits
103	Bit Operators – Topics 8
103	Bit Fields
104	Exercises
	The Preprocessor
109	The (#define) Statement – Topics 5
111	The (#include) Statement – Topics 1
114	Conditional Compilation – Topics 3
114	Exercises
	More on Data Types
115	Enumerated Data Types
116	The (typedef) Statement
118	Data Type Conversions – Topics 2
110	Exercises
	Working with Larger Programs
120	Dividing Your Program into Multiple Files – Topics 2
123	Communication Between Modules – Topics 3
124	Other Utilities for Working with Larger
127	Programs – Topics 3
12/	Input and Output Operations in C
128	Character I/O: getcher and putchar
130	Formatted I/O: printf and scanf – Topics 2
132	Input and Output Operations with Files – Topics 2
141	Special Functions for Working with Files – Topics 9
7.4.T	Exercises
	Miscellaneous and Advanced Features
	Miscellaneous and Advanced Features

4.40	
143	Miscellaneous Language Statements – Topics 2
144	Working with Unions
145	The Comma Operator
148	Type Qualifiers – Topics 3
149	Command-Line Arguments
152	Dynamic Memory Allocation – Topics 3
	Debugging Programs
153	Debugging with the Preprocessor
160	Debugging Programs with gdb – Topics 7
	Object-Oriented Programming
161	What is an Object Anyway
162	Instances and Methods
163	Writing a C Program to Work with Fractions
164	Defining Objective-C Class to Work with Fractions
165	Defining a C++ Class to Work with Fractiosn
166	Defining a C# Class to Work with Fractions
	The Standard C Library
171	Standard Header Files – Topics 5
172	String Functions
173	Memory Functions
174	Character Functions
175	I/O Functions
176	In-Memory Format Conversion Functions
177	String-to-Number Conversion
178	Dynamic Memory Allocation Functions
180	Math Functions – Topics 1
181	General Utility Functions
	Compiling Programs with gcc
182	General Command Format
183	Command-Line Options
184	Common Programming Mistakes
	•

Core Programming: Reference-2

	Object Oriented Programming with C++
	Principles of Object-Oriented Programming
01	Software Crisis
02	Software Evolution
03	A Look at Procedure-Oriented Program
04	Object-Oriented Programming Paradigm
05	Concepts of Object-Oriented Programming
06	Benefits of OOP
07	Object-Oriented Languages
08	Applications of OOP
	Beginning with C++
09	What is C++
10	Applications of C++
11	A Simple C++ Program
12	More C++ Statements
13	An Example with Class
14	Structure of C++ Program
15	Creating the Source File
16	Compiling and Linking
	Tokens, Expression and Control Structures
17	Introduction
18	Tokens
19	Keywords
20	Identifiers and Constants
21	Basic Data Types
22	User-Defined Data Types
23	Storage Classes
24	Derived Data Types
25	Symbolic Constants
26	Type Compatibility
27	Declaration of Variables
28	Dynamic Initialization of Variables
29	Reference Variables
30	Operators in C++
31	Scope Resolution Operator
32	Member Dereferencing Operators
33	Memory Management Operators
34	Manipulators
35	Type Cast Operator
36	Expressions and Their Types
37	Special Assignment Expressions
38	Implicit Conversions
39	Operator Overloading
40	Operator Precedence
41	Control Structures
1.1	Functions in C++
42	Introduction
43	The Main Function
44	Function Prototyping
45	Call by Reference Return by Reference
46	Inline Functions
47	Default Arguments
4/	Detault Alguments

Recursion Function Overloading Fined and Virtual Functions Casses and Objects Introduction Author Description of Casses and Service Servi	48	Const Arguments
50 Friend and Virtual Functions 51 Friend and Virtual Functions Classes and Objects 52 Math Library Functions 63 Introduction 64 C Structures Revisited 65 Specifying a Class 92 64 Delfining Member Functions 65 Making an Outside Function Inline 67 Nesting of Member Functions 68 Private Member Functions 69 Arrays within a Class 60 Memory Allocation for Objects 61 Static Data Members 62 Static Data Members 63 Arrays of Objects 64 Objects as Function Arguments 65 Friendly Functions 66 Returning Objects 67 (const) Member Functions 68 Private Objects 68 Pointers to Members 69 Local Classes 60 Constructors and Destructors 70 Introduction 71 Constructors 72 Parameterized Constructors 73 Multiple Constructors in a Class 74 Constructors with Default Arguments 75 Oppraine Initialization of Objects 76 Copy Constructor 77 Dynamic Initialization of Objects 78 Constructors 79 Operator Overloading and Type Conversions 79 Lintroduction 70 Destructors 71 Destructors 72 Defining Operator Overloading 73 Overloading Binary Operators 74 Overloading Binary Operators 75 Overloading Binary Operators 76 Sing Destructors 77 Sing Destructors 78 Some Other Operator Overloading Examples 78 Replaced Constructors 79 Sing Destructors 70 Sing Destructors 71 Sing Destructors 72 Destructors 73 Overloading Binary Operators 74 Overloading Binary Operators 75 Overloading Binary Operators 76 Overloading Binary Operators 77 Sing Destructor 78 Some Other Operator Overloading Examples 78 Replaced Constructors Inheritance 79 Inheritance 70 Defining Operator Members Inheritable 71 Defining Derived Classes 72 Inheritance 73 Multiple Inheritance 74 Multiple Inheritance 75 Multiple Inheritance 76 Multiple Inheritance		
51 Friend and Virtual Functions 52 Math Library Functions Classes and Objects 53 Introduction 54 C Structures Revisited 55 Specifying a Class 92 56 Defining Member Functions 57 A C++ Program with Class 58 Array within a Class 59 Arrays within a Class 50 Memory Allocation for Objects 50 Arrays within a Class 51 Static Data Members 52 A Static Data Members 53 Arrays within a Class 54 Arrays within a Class 55 A Arrays within a Class 56 Memory Allocation for Objects 57 Arrays within a Class 58 Arrays within a Class 59 Arrays within a Class 50 Memory Allocation for Objects 51 Static Data Members 52 Static Data Members 53 Arrays of Objects 54 Objects as Function Arguments 55 Friendly Functions 56 Friendly Functions 56 Friendly Functions 56 Pointers to Members 57 Introduction 58 Pointers to Members 59 Local Classes 50 Constructors and Destructors 70 Introduction 71 Constructors 72 Parameterized Constructors 73 Multiple Constructors in a Class 74 Constructors with Default Arguments 75 Dynamic Constructors 76 Copy Constructor 77 Dynamic Constructors 78 Constructors With Default Arguments 79 (const) Objects 70 Operator Overloading and Type Conversions 71 Introduction 72 Dynamic Constructors 73 Overloading Binary Operators 74 Operator Overloading Binary Operators 75 Overloading Binary Operators 76 Overloading Binary Operators 77 Some Other Operator Overloading Examples 78 Rules for Overloading Operators 78 Some Other Operator Overloading Examples 78 Rules for Overloading Operators 79 Some Other Operator Overloading Examples 79 Introduction 70 Defining Operator Overloading Examples 71 Rultiple Inheritance 72 Single Inheritance 73 Multiple Inheritance 74 Multiple Inheritance		
Classes and Objects		
Classes and Objects Introduction Constructors Revisited Constructors AD Description Constructors Constructors		
Introduction	52	
Sepedifying a Class 92 5 Specifying a Class 92 5 Defining Member Functions 5 A C++ Program with Class 6 Making an Outside Function Inline 7 Nesting of Member Functions 8 Private Member Functions 8 Private Member Functions 9 Arrays within a Class 60 Memory Allocation for Objects 61 Static Data Members 62 Static Member Functions 63 Arrays of Objects 64 Objects as Function Arguments 65 Friendly Functions 66 Returning Objects 67 (const) Member Functions 68 Pointers to Members 69 Local Classes Constructors and Destructors 70 Introduction 71 Constructors 72 Parameterized Constructors 73 Multiple Constructors in a Class 74 Constructors with Default Arguments 75 Opymalic Initialization of Objects 76 Copy Constructor 77 Dynamic Constructors 80 Destructing Two-Dimensional Arrays 79 (const) Objects 80 Destructing 81 Introduction 82 Defining Operator Overloading 83 Overloading Binary Operators 84 Overloading Binary Operators 85 Overloading Binary Operators 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 89 Type Conversions 1 Introduction 91 Defining Dereit Classes 92 Single Inheritance 93 Multiple Inheritance 94 Multiple Inheritance		·
Specifying a Class 92 Defining Member Functions A C++ Program with Class Making an Outside Function Inline Private Member Functions Private Member Functions Private Member Functions Arrays within a Class Memory Allocation for Objects Static Data Members Static Data Members Costructions Arrays of Objects Arrays of Objects Friendly Functions Returning Objects Constructors and Destructors Introduction Multiple Constructors in a Class Constructors with Default Arguments Copy Constructor Multiple Constructors Copy Construc		
Defining Member Functions A C++ Program with Class Making an Outside Function Inline Arrays of Member Functions Private Member Functions Arrays within a Class Memory Allocation for Objects Static Data Members Static Data Members Static Member Functions Friendly Functions Returning Objects Friendly Functions Returning Objects Constructors and Destructors Constructors and Destructors Dynamic Constructors Dynamic Initialization of Objects Constructors and Destructors Copy Constructor Copy Constructor Dynamic Initialization of Objects Constructors and Destructors Constructing Two-Dimensional Arrays Constructing Two-Dimensional Arrays Defining Operator Overloading Defining Operator Overloading Multiple Coversions Multiple Coversions Defining Operator Overloading Manipulation of Strings Using Operators Overloading Binary Operators Multiple Greator Verloading Classes Overloading Binary Operators Multiple Inheritance Multiple Inheritance Multiple Inheritance Multiple Inheritance Multiple Inheritance	54	C Structures Revisited
55 AC++ Program with Class 56 Making an Outside Function Inline 57 Nesting of Member Functions 58 Private Member Functions 59 Arrays within a Class 60 Memory Allocation for Objects 61 Static Data Members 62 Static Member Functions 63 Arrays of Objects 64 Objects as Function Arguments 65 Friendly Functions 66 Returning Objects 67 (const) Member Functions 68 Pointers to Members 69 Local Classes Constructors and Destructors 70 Introduction 71 Constructors 72 Parameterized Constructors 73 Multiple Constructors in a Class 74 Constructors with Default Arguments 75 Dynamic Initialization of Objects 76 Copy Constructor 77 Dynamic Constructors 78 Constructors 79 (const) Objects 79 (const) Objects 79 (const) Objects 70 Destructors 71 Destructors 72 Destructors 73 Multiple Constructors 74 Constructors in a Class 75 Opynamic Initialization of Objects 76 Copy Constructor 77 Dynamic Constructors 78 Constructors 79 (const) Objects 70 Destructors 71 Destructors 72 Destructors 73 Destructors 74 Overloading Janary Operators 75 Overloading Binary Operators 76 Overloading Binary Operators 77 Overloading Binary Operators 78 Overloading Binary Operators 78 Overloading Binary Operators 78 Overloading Binary Operators 79 Overloading Binary Operators 70 Some Other Operator Overloading Examples 71 Some Other Operator Overloading Examples 72 Some Other Operator Overloading Examples 73 Multiple Inheritance 74 Multiple Inheritance 75 Multiple Inheritance 75 Multiple Inheritance 75 Multiple Inheritance	55	Specifying a Class 92
56 Making an Outside Functions 57 Nesting of Member Functions 58 Private Member Functions 59 Arrays within a Class 60 Memory Allocation for Objects 61 Static Data Members 62 Static Member Functions 63 Arrays of Objects 64 Objects as Function Arguments 65 Friendly Functions 66 Returning Objects 67 (const) Member Functions 68 Pointers to Members 69 Local Classes Constructors and Destructors 70 Introduction 11 Constructors 72 Parameterized Constructors 73 Multiple Constructors in a Class 74 Constructors with Default Arguments 75 Dynamic Initialization of Objects 76 Copy Constructor 77 Dynamic Constructors 78 Constructing Two-Dimensional Arrays 9 (const) Objects 80 Destructors	54	Defining Member Functions
57 Nesting of Member Functions 58 Private Member Functions 59 Arrays within a Class 60 Memory Allocation for Objects 61 Static Data Members 62 Static Member Functions 63 Arrays of Objects 64 Objects as Function Arguments 65 Friendly Functions 66 Returning Objects 67 (const) Member Functions 68 Pointers to Members 69 Local Classes Constructors and Destructors 70 Introduction 71 Constructors 72 Parameterized Constructors 73 Multiple Constructors with Default Arguments 75 Dynamic Initialization of Objects 76 Copy Constructor 77 Dynamic Constructors 78 Constructing Two-Dimensional Arrays 79 (const) Objects 80 Destructors 81 Introduction 82 Defining Operator Overloading and Type Conversions <td>55</td> <td>A C++ Program with Class</td>	55	A C++ Program with Class
58 Private Member Functions 59 Arrays within a Class 60 Memory Allocation for Objects 61 Static Data Members 62 Static Member Functions 63 Arrays of Objects 64 Objects as Function Arguments 65 Friendly Functions 66 Returning Objects 67 (const) Member Functions 68 Pointers to Members 69 Local Classes 69 Local Classes 70 Introduction 71 Constructors 72 Parameterized Constructors 73 Multiple Constructors in a Class 74 Constructors with Default Arguments 75 Dynamic Initialization of Objects 76 Copy Constructor 77 Dynamic Constructors 78 Constructing Two-Dimensional Arrays 79 (const) Objects 80 Destructors 9 Operator Overloading and Type Conversions 81 Introduction <td>56</td> <td>Making an Outside Function Inline</td>	56	Making an Outside Function Inline
58 Private Member Functions 59 Arrays within a Class 60 Memory Allocation for Objects 61 Static Data Members 62 Static Member Functions 63 Arrays of Objects 64 Objects as Function Arguments 65 Friendly Functions 66 Returning Objects 67 (const) Member Functions 68 Pointers to Members 69 Local Classes 69 Local Classes 70 Introduction 71 Constructors 72 Parameterized Constructors 73 Multiple Constructors in a Class 74 Constructors with Default Arguments 75 Dynamic Initialization of Objects 76 Copy Constructor 77 Dynamic Constructors 78 Constructing Two-Dimensional Arrays 79 (const) Objects 80 Destructors 9 Operator Overloading and Type Conversions 81 Introduction <td>57</td> <td>Nesting of Member Functions</td>	57	Nesting of Member Functions
60 Memory Allocation for Objects 61 Static Data Members 62 Static Member Functions 63 Arrays of Objects 64 Objects as Function Arguments 65 Friendly Functions 66 Returning Objects 67 (const) Member Functions 68 Pointers to Members 69 Local Classes 69 Local Classes 69 Local Classes 69 Introduction 70 Introduction 71 Constructors and Destructors 72 Parameterized Constructors 73 Multiple Constructors in a Class 74 Constructor sin Default Arguments 75 Dynamic Onstructors 76 Copy Constructor 77 Dynamic Initialization of Objects 78 Constructors 79 (const) Objects 70 Destructors 71 Dynamic Onstructors 72 Destructors 73 Destructors 74 Constructors 75 Dynamic Initialization of Objects 76 Copy Constructor 77 Dynamic Onstructors 78 Constructing Two-Dimensional Arrays 79 (const) Objects 80 Destructors 81 Introduction 82 Defining Operator Overloading 83 Overloading Unary Operators 84 Overloading Unary Operators 85 Overloading Binary Operators 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 90 Introduction 91 Defining Derived Classes 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multitple Inheritance	58	
60 Memory Allocation for Objects 61 Static Data Members 62 Static Member Functions 63 Arrays of Objects 64 Objects as Function Arguments 65 Friendly Functions 66 Returning Objects 67 (const) Member Functions 68 Pointers to Members 69 Local Classes 69 Local Classes 69 Local Classes 69 Introduction 70 Introduction 71 Constructors and Destructors 72 Parameterized Constructors 73 Multiple Constructors in a Class 74 Constructor sin Default Arguments 75 Dynamic Onstructors 76 Copy Constructor 77 Dynamic Initialization of Objects 78 Constructors 79 (const) Objects 70 Destructors 71 Dynamic Onstructors 72 Destructors 73 Destructors 74 Constructors 75 Dynamic Initialization of Objects 76 Copy Constructor 77 Dynamic Onstructors 78 Constructing Two-Dimensional Arrays 79 (const) Objects 80 Destructors 81 Introduction 82 Defining Operator Overloading 83 Overloading Unary Operators 84 Overloading Unary Operators 85 Overloading Binary Operators 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 90 Introduction 91 Defining Derived Classes 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multitple Inheritance	59	Arrays within a Class
61 Static Data Members 62 Static Member Functions 63 A rrays of Objects 64 Objects as Function Arguments 65 Friendly Functions 66 Returning Objects 67 (const) Member Functions 68 Pointers to Members 69 Local Classes Constructors and Destructors 70 Introduction 71 Constructors 72 Parameterized Constructors 73 Multiple Constructors in a Class 74 Constructors with Default Arguments 75 Dynamic Initialization of Objects 76 Copy Constructor 77 Dynamic Constructors 78 Constructing Two-Dimensional Arrays 79 (const) Objects 80 Destructors 9 Operator Overloading and Type Conversions 81 Introduction 82 Defining Operator Overloading 83 Overloading Binary Operators 84 Overloading Binary Operators 85 Overloading Binary Operators 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Ope		
62 Static Member Functions 63 Arrays of Objects 64 Objects as Function Arguments 65 Friendly Functions 66 Returning Objects 67 (const) Member Functions 68 Pointers to Members 69 Local Classes 69 Constructors and Destructors 70 Introduction 71 Constructors 72 Parameterized Constructors 73 Multiple Constructors in a Class 74 Constructors with Default Arguments 75 Dynamic Initialization of Objects 76 Copy Constructor 77 Dynamic Constructors 78 Constructors 79 (const) Objects 79 (const) Objects 79 (const) Objects 79 (const) Objects 79 Destructors 79 Destructors 70 Destructors 70 Destructors 71 Destructors 72 Destructors 73 Multiple Operator Overloading 74 Overloading Binary Operators 75 Overloading Binary Operators 76 Overloading Binary Operators 77 Overloading Binary Operators 80 Destruction 81 Introduction 82 Defining Operator Overloading 83 Overloading Binary Operators 84 Overloading Binary Operators 85 Overloading Binary Operators 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 89 Type Conversions 1 Introduction 1 Defining Derived Classes 90 Introduction 1 Defining Derived Classes 91 Single Inheritance 92 Multiple Inheritance 93 Making a Private Member Inheritable 94 Multiple Inheritance		
63 Arrays of Objects 64 Objects as Function Arguments 65 Friendly Functions 66 Returning Objects 67 (const) Member Functions 68 Pointers to Members 69 Local Classes 60 Introduction 70 Introduction 71 Constructors 72 Parameterized Constructors 73 Multiple Constructors in a Class 74 Constructors with Default Arguments 75 Dynamic Initialization of Objects 76 Copy Constructor 77 Dynamic Constructors 78 Constructing Two-Dimensional Arrays 79 (const) Objects 80 Destructors 81 Introduction 82 Defining Operator Overloading 83 Overloading Binary Operators 84 Overloading Binary Operators 85 Overloading Binary Operators 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 89 Type Conversions 1 Introduction 90 Introduction 91 Defining Operator Overloading Examples 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multiple Inheritance		
64 Objects as Function Arguments 65 Friendly Functions 66 Returning Objects 67 (const) Member Functions 68 Pointers to Members 69 Local Classes Constructors and Destructors 70 Introduction 71 Constructors 72 Parameterized Constructors 73 Multiple Constructors in a Class 74 Constructors with Default Arguments 75 Dynamic Initialization of Objects 76 Copy Constructor 77 Dynamic Constructors 78 Constructing Two-Dimensional Arrays 79 (const) Objects 80 Destructors 81 Introduction 82 Defining Operator Overloading 83 Overloading Binary Operators 84 Overloading Binary Operators 85 Overloading Binary Operators 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Qperators 89 Type Conversions 80 Introduction 81 Introduction 82 Defining Operator Overloading Examples 83 Overloading Binary Operators 84 Overloading Binary Operators 85 Overloading Operator Overloading Examples 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 89 Type Conversions 89 Inheritance: Extending Classes 90 Introduction 91 Defining Derived Classes 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multilevel Inheritance		
65 Friendly Functions 66 Returning Objects 67 (const) Member Functions 68 Pointers to Members 69 Local Classes Constructors and Destructors 70 Introduction 71 Constructors 72 Parameterized Constructors 73 Multiple Constructors in a Class 74 Constructors with Default Arguments 75 Dynamic Initialization of Objects 76 Copy Constructor 77 Dynamic Constructors 78 Constructors 79 (const) Objects 79 (const) Objects 80 Destructors 80 Destructors 81 Introduction 82 Defining Operator Overloading 83 Overloading Binary Operators 84 Overloading Binary Operators 85 Overloading Binary Operators 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 89 Type Conversions 80 Introduction 81 Introduction 82 Defining Operator Overloading Examples 83 Overloading Binary Operators 84 Overloading Binary Operators 85 Overloading Deprator Overloading Examples 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 89 Type Conversions 89 Introduction 90 Introduction 91 Defining Derived Classes 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multiple Inheritance		•
66 Returning Objects 67 (const) Member Functions 68 Pointers to Members 69 Local Classes Constructors and Destructors 70 Introduction 71 Constructors 72 Parameterized Constructors 73 Multiple Constructors in a Class 74 Constructors with Default Arguments 75 Dynamic Initialization of Objects 76 Copy Constructors 77 Dynamic Constructors 78 Constructing Two-Dimensional Arrays 79 (const) Objects 80 Destructors 81 Introduction 82 Defining Operator Overloading 83 Overloading Binary Operators 84 Overloading Binary Operators 85 Overloading Binary Operators 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 89 Type Conversions 10 Introduction 11 Introduction 12 Some Other Operator Overloading Examples 13 Introduction 14 Operator Overloading Departors 15 Some Other Operator Overloading Examples 16 Manipulation of Strings Using Operators 17 Jupe Conversions 18 Rules for Overloading Operators 18 Some Other Operator Overloading Examples 18 Rules for Overloading Operators 19 Some Other Operator Overloading Examples 19 Introduction 10 Defining Derived Classes 11 Defining Derived Classes 12 Single Inheritance 13 Making a Private Member Inheritable 14 Multilevel Inheritance 15 Multiple Inheritance		,
67 (const) Member Functions 68 Pointers to Members 69 Local Classes Constructors and Destructors 70 Introduction 71 Constructors 72 Parameterized Constructors 73 Multiple Constructors in a Class 74 Constructors with Default Arguments 75 Dynamic Initialization of Objects 76 Copy Constructor 77 Dynamic Constructors 78 Constructors 79 (const) Objects 80 Destructors 80 Destructors 81 Introduction 82 Defining Operator Overloading 83 Overloading Unary Operators 84 Overloading Binary Operators 85 Overloading Binary Operators 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 89 Type Conversions Interduction 90 Interduction 91 Defining Operator Overloading Examples 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multiple Inheritance		·
68 Pointers to Members 69 Local Classes Constructors and Destructors 70 Introduction 71 Constructors 72 Parameterized Constructors 73 Multiple Constructors in a Class 74 Constructors with Default Arguments 75 Dynamic Initialization of Objects 76 Copy Constructor 77 Dynamic Constructors 78 Constructors 79 (const) Objects 79 (const) Objects 70 Destructors 70 Destructors 71 Destructors 72 Destructors 73 Constructing Two-Dimensional Arrays 74 Constructing Two-Dimensional Arrays 75 Destructors 76 Constructing Two-Dimensional Arrays 77 (const) Objects 80 Destructors 81 Introduction 82 Defining Operator Overloading 83 Overloading Unary Operators 84 Overloading Binary Operators 85 Overloading Binary Operators 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 89 Type Conversions Inheritance: Extending Classes 90 Introduction 91 Defining Derived Classes 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multilevel Inheritance		
69 Local Classes Constructors and Destructors 70 Introduction 71 Constructors 72 Parameterized Constructors 73 Multiple Constructors in a Class 74 Constructors with Default Arguments 75 Dynamic Initialization of Objects 76 Copy Constructor 77 Dynamic Initialization of Objects 78 Constructing Two-Dimensional Arrays 79 (const) Objects 80 Destructors 80 Destructors 81 Introduction 82 Defining Operator Overloading and Type Conversions 81 Introduction 82 Defining Operator Overloading 83 Overloading Unary Operators 84 Overloading Binary Operators 85 Overloading Binary Operators 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 89 Type Conversions Inheritance: Extending Classes 90 Introduction 91 Defining Derived Classes 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multilevel Inheritance		
Constructors and Destructors 70 Introduction 71 Constructors 72 Parameterized Constructors 73 Multiple Constructors in a Class 74 Constructors with Default Arguments 75 Dynamic Initialization of Objects 76 Copy Constructor 77 Dynamic Constructors 8 Constructing Two-Dimensional Arrays 79 (const) Objects 80 Destructors 90 Destructors 91 Introduction 82 Defining Operator Overloading 83 Overloading Unary Operators 84 Overloading Binary Operators 85 Overloading Binary Operators 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 89 Type Conversions Inheritance: Extending Classes 90 Introduction 91 Defining Derived Classes 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multilevel Inheritance		
70 Introduction 71 Constructors 72 Parameterized Constructors 73 Multiple Constructors in a Class 74 Constructors with Default Arguments 75 Dynamic Initialization of Objects 76 Copy Constructor 77 Dynamic Constructors 78 Constructing Two-Dimensional Arrays 79 (const) Objects 80 Destructors 81 Introduction 82 Defining Operator Overloading 83 Overloading Unary Operators 84 Overloading Binary Operators 85 Overloading Binary Operators Using Friends 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 89 Type Conversions Inheritance: Extending Classes 90 Introduction 91 Defining Derived Classes 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multilevel Inheritance	69	
71 Constructors 72 Parameterized Constructors 73 Multiple Constructors in a Class 74 Constructors with Default Arguments 75 Dynamic Initialization of Objects 76 Copy Constructor 77 Dynamic Constructors 78 Constructing Two-Dimensional Arrays 79 (const) Objects 80 Destructors 81 Introduction 82 Defining Operator Overloading 83 Overloading Unary Operators 84 Overloading Binary Operators 85 Overloading Binary Operators 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 89 Type Conversions 80 Introduction 81 Introduction 82 Defining Derived Classes 83 Overloading Binary Operators 84 Overloading Binary Operators 85 Overloading Binary Operators 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Classes 90 Introduction 91 Defining Derived Classes 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multiple Inheritance		
72 Parameterized Constructors 73 Multiple Constructors in a Class 74 Constructors with Default Arguments 75 Dynamic Initialization of Objects 76 Copy Constructor 77 Dynamic Constructors 78 Constructing Two-Dimensional Arrays 79 (const) Objects 80 Destructors 81 Introduction 82 Defining Operator Overloading 83 Overloading Unary Operators 84 Overloading Binary Operators 85 Overloading Binary Operators 86 Manipulation of Strings Using Priends 87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 89 Type Conversions 80 Introduction 81 Introduction 82 Defining Derived Classes 83 Overloading Binary Operators 84 Overloading Binary Operators 85 Overloading Binary Operators 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 89 Type Conversions 80 Introduction 91 Defining Derived Classes 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multilevel Inheritance		
73 Multiple Constructors in a Class 74 Constructors with Default Arguments 75 Dynamic Initialization of Objects 76 Copy Constructor 77 Dynamic Constructors 78 Constructing Two-Dimensional Arrays 79 (const) Objects 80 Destructors Operator Overloading and Type Conversions 81 Introduction 82 Defining Operator Overloading 83 Overloading Unary Operators 84 Overloading Binary Operators 85 Overloading Binary Operators 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 89 Type Conversions Inheritance: Extending Classes 90 Introduction 91 Defining Derived Classes 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multiple Inheritance		
74 Constructors with Default Arguments 75 Dynamic Initialization of Objects 76 Copy Constructor 77 Dynamic Constructors 78 Constructing Two-Dimensional Arrays 79 (const) Objects 80 Destructors 80 Destructors 81 Introduction 82 Defining Operator Overloading 83 Overloading Binary Operators 84 Overloading Binary Operators 85 Overloading Binary Operators 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 89 Type Conversions 80 Introduction 91 Defining Derived Classes 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multiple Inheritance 95 Multiple Inheritance		
75 Dynamic Initialization of Objects 76 Copy Constructor 77 Dynamic Constructors 78 Constructing Two-Dimensional Arrays 79 (const) Objects 80 Destructors Operator Overloading and Type Conversions 81 Introduction 82 Defining Operator Overloading 83 Overloading Unary Operators 84 Overloading Binary Operators 85 Overloading Binary Operators 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 89 Type Conversions Inheritance: Extending Classes 90 Introduction 91 Defining Derived Classes 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multilevel Inheritance 95 Multiple Inheritance	73	·
76 Copy Constructor 77 Dynamic Constructors 78 Constructing Two-Dimensional Arrays 79 (const) Objects 80 Destructors Operator Overloading and Type Conversions 81 Introduction 82 Defining Operator Overloading 83 Overloading Unary Operators 84 Overloading Binary Operators 85 Overloading Binary Operators Using Friends 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 89 Type Conversions Inheritance: Extending Classes 90 Introduction 91 Defining Derived Classes 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multilevel Inheritance 95 Multiple Inheritance		Constructors with Default Arguments
77 Dynamic Constructors 78 Constructing Two-Dimensional Arrays 79 (const) Objects 80 Destructors Operator Overloading and Type Conversions 81 Introduction 82 Defining Operator Overloading 83 Overloading Unary Operators 84 Overloading Binary Operators 85 Overloading Binary Operators Using Friends 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 89 Type Conversions Inheritance: Extending Classes 90 Introduction 91 Defining Derived Classes 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multilevel Inheritance 95 Multiple Inheritance	75	Dynamic Initialization of Objects
78 Constructing Two-Dimensional Arrays 79 (const) Objects 80 Destructors Operator Overloading and Type Conversions 81 Introduction 82 Defining Operator Overloading 83 Overloading Unary Operators 84 Overloading Binary Operators 85 Overloading Binary Operators 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 89 Type Conversions Inheritance: Extending Classes 90 Introduction 91 Defining Derived Classes 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multilevel Inheritance 95 Multiple Inheritance	76	Copy Constructor
79 (const) Objects 80 Destructors Operator Overloading and Type Conversions 81 Introduction 82 Defining Operator Overloading 83 Overloading Unary Operators 84 Overloading Binary Operators 85 Overloading Binary Operators 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 89 Type Conversions Inheritance: Extending Classes 90 Introduction 91 Defining Derived Classes 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multilevel Inheritance	77	Dynamic Constructors
BO Destructors Operator Overloading and Type Conversions 81 Introduction 82 Defining Operator Overloading 83 Overloading Unary Operators 84 Overloading Binary Operators 85 Overloading Binary Operators Using Friends 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 89 Type Conversions Inheritance: Extending Classes 90 Introduction 91 Defining Derived Classes 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multilevel Inheritance 95 Multiple Inheritance	78	Constructing Two-Dimensional Arrays
Operator Overloading and Type Conversions81Introduction82Defining Operator Overloading83Overloading Unary Operators84Overloading Binary Operators85Overloading Binary Operators Using Friends86Manipulation of Strings Using Operators87Some Other Operator Overloading Examples88Rules for Overloading Operators89Type ConversionsInheritance: Extending Classes90Introduction91Defining Derived Classes92Single Inheritance93Making a Private Member Inheritable94Multiple Inheritance95Multiple Inheritance	79	(const) Objects
81Introduction82Defining Operator Overloading83Overloading Unary Operators84Overloading Binary Operators85Overloading Binary Operators Using Friends86Manipulation of Strings Using Operators87Some Other Operator Overloading Examples88Rules for Overloading Operators89Type ConversionsInheritance: Extending Classes90Introduction91Defining Derived Classes92Single Inheritance93Making a Private Member Inheritable94Multiple Inheritance95Multiple Inheritance	80	Destructors
81Introduction82Defining Operator Overloading83Overloading Unary Operators84Overloading Binary Operators85Overloading Binary Operators Using Friends86Manipulation of Strings Using Operators87Some Other Operator Overloading Examples88Rules for Overloading Operators89Type ConversionsInheritance: Extending Classes90Introduction91Defining Derived Classes92Single Inheritance93Making a Private Member Inheritable94Multiple Inheritance95Multiple Inheritance		Operator Overloading and Type Conversions
82Defining Operator Overloading83Overloading Unary Operators84Overloading Binary Operators85Overloading Binary Operators Using Friends86Manipulation of Strings Using Operators87Some Other Operator Overloading Examples88Rules for Overloading Operators89Type ConversionsInheritance: Extending Classes90Introduction91Defining Derived Classes92Single Inheritance93Making a Private Member Inheritable94Multilevel Inheritance95Multiple Inheritance	81	
83Overloading Unary Operators84Overloading Binary Operators85Overloading Binary Operators Using Friends86Manipulation of Strings Using Operators87Some Other Operator Overloading Examples88Rules for Overloading Operators89Type ConversionsInheritance: Extending Classes90Introduction91Defining Derived Classes92Single Inheritance93Making a Private Member Inheritable94Multilevel Inheritance95Multiple Inheritance		
84 Overloading Binary Operators 85 Overloading Binary Operators Using Friends 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 89 Type Conversions Inheritance: Extending Classes 90 Introduction 91 Defining Derived Classes 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multilevel Inheritance 95 Multiple Inheritance		
85 Overloading Binary Operators Using Friends 86 Manipulation of Strings Using Operators 87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 89 Type Conversions Inheritance: Extending Classes 90 Introduction 91 Defining Derived Classes 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multilevel Inheritance 95 Multiple Inheritance		
 Manipulation of Strings Using Operators Some Other Operator Overloading Examples Rules for Overloading Operators Type Conversions Inheritance: Extending Classes Introduction Defining Derived Classes Single Inheritance Making a Private Member Inheritable Multilevel Inheritance Multiple Inheritance Multiple Inheritance		
87 Some Other Operator Overloading Examples 88 Rules for Overloading Operators 89 Type Conversions Inheritance: Extending Classes 90 Introduction 91 Defining Derived Classes 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multilevel Inheritance 95 Multiple Inheritance		
88 Rules for Overloading Operators 89 Type Conversions Inheritance: Extending Classes 90 Introduction 91 Defining Derived Classes 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multilevel Inheritance 95 Multiple Inheritance		
89 Type Conversions Inheritance: Extending Classes 90 Introduction 91 Defining Derived Classes 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multilevel Inheritance 95 Multiple Inheritance		
Inheritance: Extending Classes 90 Introduction 91 Defining Derived Classes 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multilevel Inheritance 95 Multiple Inheritance		
90 Introduction 91 Defining Derived Classes 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multilevel Inheritance 95 Multiple Inheritance	09	
91 Defining Derived Classes 92 Single Inheritance 93 Making a Private Member Inheritable 94 Multilevel Inheritance 95 Multiple Inheritance	00	
92 Single Inheritance 93 Making a Private Member Inheritable 94 Multilevel Inheritance 95 Multiple Inheritance		
93 Making a Private Member Inheritable 94 Multilevel Inheritance 95 Multiple Inheritance		
94 Multilevel Inheritance 95 Multiple Inheritance		
95 Multiple Inheritance		
96 Hierarchical Inheritance		
	96	Hierarchical Inheritance

97	Hybrid Inheritance
98	Virtual Base Classes
99	Abstract Classes
100	Constructors in Derived Classes
101	Member Classes: Nesting of Classes
	Pointers, Virtual Functions and Polymorphism
102	Introduction
103	Pointers
104	Pointers to Objects
105	(this) Pointer
106	Pointers to Derived Classes
107	Virtual Functions
108	Pure Virtual Functions
109	Virtual Constructors and Destructors
	Managing Console I/O Operations
110	Introduction
111	C++ Streams
112	C++ Stream Classes
113	Unformatted I/O Operations
114	Formatted Console I/O Operations
115	Managing Output with Manipulators
	Working with Files
116	Introduction
117	Classes for File Stream Operations
118	Opening and Closing a File
119	Detecting end-of-file
120	More about Open(): File Modes
121	File Pointers and their Manipulations
122	Sequential Input and Output Operations
123	Updating a File: Random Access
124	Error Handling During File Operations
125	Command-line Arguments
123	Templates
126	Introduction
127	Class Templates
128	Class Templates with Multiple Parameters
129	Function Templates
130	Function Templates with Multiple Parameters
131	Overloading of Template Functions
132	Member Function Templates
133	Nontype Template Arguments
101	Exception Handling
134	Introduction
135	Basics of Exception Handling
136	Exception Handling Mechanism
137	Throwing Mechanism
138	Catching Mechanism
139	Re-throwing an Exception
140	Specifying Exceptions
141	Exceptions in Constructors and Destructors
142	Exceptions in Operator Overloaded Functions
	Introduction to the Standard Template Library
143	Introduction
144	Components of STL
145	Containers

146	Algorithms
147	Iterators
148	Applications
149	Of Container Classes
150	Function Objects
	Manipulating Strings
151	Introduction
152	Creating (string) Objects
153	Manipulating String Objects
154	Relational Operations
155	String Characteristics
156	Accessing Characters in Strings
157	Comparing and Swapping
	New Features of ANSI C++ Standard
158	Introduction
159	New Data Types
160	New Operators
161	Class Implementation
162	Namespace Scope
163	Operator Keywords
164	New Keywords
165	New Headers
	Object-Oriented Systems Development
166	Introduction
167	Procedure-Oriented Paradigm
168	Procedure-Oriented Development Tools
169	Object-Oriented Paradigm
170	Object-Oriented Notations and Graphs
171	Steps in Object-Oriented Analysis
172	Steps in Object-Oriented Design

Core Programming: Reference-3

	The Object-Oriented Through Process
	Introduction to Object-Oriented Concepts
01	Procedural Versus OO Programming
03	Moving from Procedural to Object-Oriented Development – Topics 2
05	What Exactly is an Object – Topics 2
09	What Exactly is a Class – Topics 4
10	Using UML to Model a Class Diagram
14	Encapsulation and Data Hiding – Topics 4
17	Inheritance – Topics 3
18	Polymorphism
20	Composition – Topics 2
	Conclusion
	Example Code Used in This Chapter
	How to Think in Terms of Objects
23	Knowing the Difference Between the Interface and the Implementation – Topics 3
24	Using Abstract Thinking When Designing Interfaces
29	Giving the User the Minimal Interface Possible – Topics 5
	Conclusion
	References
	Advanced Object-Oriented Concepts
35	Constructors – Topics 6
39	Error Handling – Topics 4
42	The Concept of Scope – Topics 3
43	Operator Overloading
44	Multiple Inheritance
45	Object Operations
	Conclusion
	References
	Example Code Used in This Chapter
	The Anatomy of a Class
46	The Name of the Class
47	Comments
48	Attributes
49	Constructors
50	Accessors
51	Public Interface Methods
52	Private Implementation Methods
32	Conclusion
	References
	Example Code Used in This Chapter
	Class Design Guidelines
53	Modeling Real World Systems
55	Identifying the Public Interfaces – Topics 2
56	Designing Robust Constructors (and Perhaps Destructors)
57	Designing Robust Constructors (and Perhaps Destructors) Designing Error Handling into a Class
59	Documenting a Class and Using Comments – Topics 1
60	Designing with Reuse in Mind – Topics 1
65	Designing with Reuse in Wind – Topics 1 Designing with Extensibility in Mind – Topics 5
67	Designing with Extensionity in Wind – Topics 3 Designing with Maintainability in Mind – Topics 2
68	Using Object Persistence – Topics 1
03	Conclusion
	References
	Welel elices

	Example Code Used in This Chapter
	Designing with Objects
76	Design Guidelines – Topics 8
83	Case Study: A Blackjack Example – Topics 7
65	Conclusion
	References
0.4	Mastering Inheritance and Composition
84	Reusing Objects
86	Inheritance – Topics 2
87	Composition – Topics 1
90	Why Encapsulation is Fundamental to OO – Topics 3
	Conclusion
	References Francis Code Head in This Charter
	Example Code Used in This Chapter
0.4	Frameworks and Reuse: Designing with Interfaces and Abstract Classes
91	Code: To Reuse or Not to Reuse?
92	What is a Framework?
98	What is a Contract? – Topics 6
102	An E-Business Example – Topics 4
	Conclusion
	References
	Example Code Used in This Chapter
	Building Objects
103	Composition Relationships
104	Building in Phases
107	Types of Composition – Topics 3
108	Avoiding Dependencies
110	Cardinality – Topics 2
111	Tying It All Together: An Example
	Conclusion
	References
	Creating Object Models with UML
112	What is UML
113	The Structure of a Class Diagram
115	Attributes and Methods – Topics 2
116	Access Designations
117	Inheritance
118	Interfaces
120	Composition – Topics 2
121	Cardinality
	Conclusion
	References
	Objects and Portable Data: XML
122	Portable Data
123	The Extensible Markup Language (XML)
124	XML Versus HTML
125	XML and Object-Oriented Languages
126	Sharing Data Between Two Companies
127	Validating the Document with the Document Type Definition (DTD)
128	Integrating the DTD into the XML Document
129	Using Cascading Style Sheets
	Conclusion
	References
	Persistent Objects: Serialization and Relational Databases
130	Persistent Objects Basics

400	
133	Saving the Object to a Flat File – Topics 3
134	Using XML in the Serialization Process
135	Writing to a Relational Database – Topics 1
137	Loading the Driver – Topics 2
	Conclusion
	References
	Example Code Used in This Chapter
	Objects and the Internet
138	Evolution of Distributed Computing
139	Object-Based Scripting Languages
140	A JavaScript Validation Example
145	Objects in a Web Page – Topics 5
150	Distributed Objects and the Enterprise – Topics 5
	Conclusion
	References
	Objects and Client/Server Applications
151	Client/Server Approaches
155	Proprietary Approach – Topics 4
159	Nonproprietary Approach – Topics 4
	Conclusion
	References
	Example Code Used in This Chapter
	Design Patterns
160	Why Design Patterns?
161	Smalltalk's Model/View/Controller
164	Types of Design Patterns – Topics 3
165	Anti-patterns
	Conclusion
	References
	Example Code Used in This Chapter

Discrete Mathematics

The Foundations: Logic and Proofs 06 Propositional Logic - Topics 6 12 Applications of Propositional Logic - Topics 6 19 Propositional Equivalences - Topics 7 32 Predicates and Quantifiers - Topics 13 39 Nested Quantifiers - Topics 7 4 Rules of Inference - Topics 8 56 Introduction to Proofs - Topics 9 66 Proof Methods and Strategy - Topics 10 End-of-Chapter Material 8 Basic Structures: Sets, Functions, Sequences, Sums 74 Sets - Topics 8 75 Set Operations - Topics 5 85 Functions - Topics 5 85 Functions - Topics 6 90 Sequences and Summations - Topics 5 91 Sequences and Summations - Topics 5 92 Adardinality of Sets - Topics 3 93 Matrices - Topics 4 End-of-Chapter Material Algorithms - Topics 6 103 Algorithms - Topics 5 113 Complexity of Algorithms - Topics 5 114 Divisibility and Modular Arithmetic - Topics 5 115 Integer Representations and Algorithms - Topics 5 116 Divisibility and Modular Arithmetic - Topics 5 117 Mumber Theory and Cryptography 118 Divisibility and Modular Arithmetic - Topics 5 119 Cryptography - Topics 7 140 Applications of Congruencies - Topics 7 140 Applications of Congruencies - Topics 8 151 Recursive Algorithms - Topics 9 152 End-of-Chapter Material 153 Material Induction - Topics 9 164 Recursive Definitions and Structural Induction - Topics 5 165 Recursive Definitions and Structural Induction - Topics 5 166 Recursive Definitions and Structural Induction - Topics 5 167 Recursive Algorithms - Topics 5 168 The Program Correctness - Topics 5 170 Recursive Algorithms - Topics 6 171 Recursive Algorithms - Topics 6 172 Recursive Algorithms - Topics 5 173 Generalized Permutations and Combinations - Topics 5 174 Recursive Definitions and Structural Induction - Topics 5 175 Recursive Definitions and Combinations - Topics 3 176 Generalized Permutations and Combinations - Topics 3 177 Generalized Permutations and Combinations - Topics 5 178 Generalized Permutations and Combinations - Topics 3 179 Generalized Permutations and Combinations - Topics 3 179 G		Discorde Adulta continue and the Adultantinue
Propositional Logic - Topics 6		
12 Applications of Propositional Logic — Topics 6 19 Propositional Equivalences — Topics 7 32 Predicates and Quantifiers — Topics 7 47 Rules of Inference — Topics 8 56 Introduction to Proofs — Topics 9 66 Proof Methods and Strategy — Topics 10 End-of-Chapter Material Basic Structures: Sets, Functions, Sequences, Sums 74 Sets — Topics 8 79 Set Operations — Topics 5 85 Functions — Topics 5 87 Functions — Topics 5 89 Cardinality of Sets — Topics 3 90 Adartices — Topics 4 80 End-of-Chapter Material 80 Algorithms 103 Algorithms 103 Algorithms — Topics 6 108 The Growth of Functions — Topics 5 113 Complexity of Algorithms — Topics 5 114 Divisibility and Modular Arithmetic — Topics 5 115 End-of-Chapter Material 116 Number Theory and Cryptography 117 Divisibility and Modular Arithmetic — Topics 4 130 Primes and Greatest Common Divisors — Topics 8 137 Solving Congruencies — Topics 7 140 Applications of Congruencies — Topics 7 140 Applications of Congruencies — Topics 9 140 Cryptography — Topics 9 141 Cryptography — Topics 9 142 Integer Representations and Algorithms — Topics 3 143 Cryptography — Topics 9 144 Cryptography — Topics 9 157 Mathematical Induction — Topics 5 167 Recursive Definitions and Structural Induction — Topics 5 168 Recursive Definitions and Structural Induction — Topics 5 169 Program Correctness — Topics 4 170 Program Correctness — Topics 4 171 Recursive Algorithms — Topics 5 172 Recursive Definitions and Structural Induction — Topics 5 173 Recursive Definitions and Structural Induction — Topics 5 174 Recursive Definitions and Structural Induction — Topics 5 175 End-of-Chapter Material 176 Program Correctness — Topics 3 177 Recursive Definitions and Combinations — Topics 5 178 Generalized Permutations and Combinations — Topics 5 179 Generalized Permutations and Combinations — Topics 5	0.0	
19 Propositional Equivalences – Topics 7 32 Predicates and Quantifiers – Topics 13 39 Nested Quantifiers – Topics 8 56 Introduction to Proofs – Topics 9 66 Proof Methods and Strategy – Topics 10 End-of-Chapter Material Basic Structures: Sets, Functions, Sequences, Sums 74 Sets – Topics 8 79 Set Operations – Topics 5 85 Functions – Topics 6 90 Sequences and Summations – Topics 5 93 Cardinality of Sets – Topics 3 97 Matrices – Topics 4 End-of-Chapter Material Algorithms 103 Algorithms – Topics 6 108 The Growth of Functions – Topics 5 113 Complexity of Algorithms – Topics 5 End-of-Chapter Material Number Theory and Cryptography 118 Divisibility and Modular Arithmetic – Topics 5 122 Integer Representations and Algorithms – Topics 8 137 Solving Congruencies – Topics 7 140 Applications of Congruencies – Topics 9 End-of-Chapter Material Induction and Recursion 157 Mathematical Induction – Topics 8 162 Strong Induction and Well-Ordering – Topics 5 171 Recursive Algorithms – Topics 9 End-of-Chapter Material Induction and Recursion 157 Recursive Definitions and Structural Induction – Topics 5 171 Recursive Definitions and Structural Induction – Topics 5 171 Recursive Definitions and Structural Induction – Topics 5 171 Recursive Definitions and Combinations – Topics 3 183 Permutations and Combinations – Topics 3 184 Permutations and Combinations – Topics 5 185 The Pigeonhole Principle – Topics 3 186 Generalized Permutations and Combinations – Topics 5 199 Generating Permutations and Combinations – Topics 5		
Predicates and Quantifiers — Topics 13		
Nested Quantifiers – Topics 7		
A7		
S6		
66 Proof Methods and Strategy – Topics 10 End-of-Chapter Material Basic Structures: Sets, Functions, Sequences, Sums 74 Sets – Topics 8 79 Set Operations – Topics 5 85 Functions – Topics 6 90 Sequences and Summations – Topics 5 93 Cardinality of Sets – Topics 3 97 Matrices – Topics 4 End-of-Chapter Material Algorithms 103 Algorithms – Topics 6 108 The Growth of Functions – Topics 5 End-of-Chapter Material Number Theory and Cryptography 118 Divisibility and Modular Arithmetic – Topics 5 122 Integer Representations and Algorithms – Topics 8 137 Solving Congruencies – Topics 7 140 Applications of Congruencies – Topics 3 149 Cryptography – Topics 9 End-of-Chapter Material Induction and Recursion 157 Mathematical Induction – Topics 8 162 Strong Induction and Well-Ordering – Topics 5 171 Recursive Definitions and Structural Induction – Topics 5 174 Program Correctness – Topics 4 176 Program Correctness – Topics 5 177 Recursive Definitions and Structural Induction – Topics 5 178 End-of-Chapter Material 179 Program Correctness – Topics 5 170 Recursive Definitions and Structural Induction – Topics 5 171 Recursive Algorithms – Topics 4 176 Program Correctness – Topics 5 177 End-of-Chapter Material 178 Program Correctness – Topics 5 179 End-of-Chapter Material 170 Program Correctness – Topics 5 171 Recursive Algorithms – Topics 6 172 The Basics of Counting – Topics 6 173 The Pigeonhole Principle – Topics 3 174 Generalized Permutations and Combinations – Topics 3 175 Generalized Permutations and Combinations – Topics 3		
End-of-Chapter Material Basic Structures: Sets, Functions, Sequences, Sums 74 Sets — Topics 8 79 Set Operations — Topics 5 85 Functions — Topics 6 90 Sequences and Summations — Topics 5 91 Cardinality of Sets — Topics 3 92 Matrices — Topics 4 End-of-Chapter Material Algorithms 103 Algorithms — Topics 6 108 The Growth of Functions — Topics 5 End-of-Chapter Material Number Theory and Cryptography 118 Divisibility and Modular Arithmetic — Topics 5 120 Integer Representations and Algorithms — Topics 8 137 Solving Congruencies — Topics 7 140 Applications of Congruencies — Topics 3 149 Cryptography — Topics 9 End-of-Chapter Material Induction and Recursion Mathematical Induction — Topics 8 162 Strong Induction and Structural Induction — Topics 5 167 Recursive Definitions and Structural Induction — Topics 5 End-of-Chapter Material Counting 188 Permutations and Combinations — Topics 3 189 Generalized Permutations and Combinations — Topics 3 190 Generating Permutations and Combinations — Topics 3 191 Binominal Coefficients and Identities — Topics 3 192 Generating Permutations and Combinations — Topics 3		
Basic Structures: Sets, Functions, Sequences, Sums 74	66	
74 Sets – Topics 8 79 Set Operations – Topics 5 85 Functions – Topics 6 90 Sequences and Summations – Topics 5 93 Cardinality of Sets – Topics 3 97 Matrices – Topics 4 End-of-Chapter Material Algorithms 103 Algorithms – Topics 6 108 The Growth of Functions – Topics 5 113 Complexity of Algorithms – Topics 5 End-of-Chapter Material Number Theory and Cryptography 118 Divisibility and Modular Arithmetic – Topics 5 122 Integer Representations and Algorithmes – Topics 8 137 Solving Congruencies – Topics 7 140 Applications of Congruencies – Topics 3 149 Cryptography – Topics 9 End-of-Chapter Material Induction and Recursion 157 Mathematical Induction – Topics 8 162 Strong Induction and Well-Ordering – Topics 5 163 Recursive Definitions and Structural Induction – Topics 5 164 Program Correctness – Topics 5 165 End-of-Chapter Material 166 Program Correctness – Topics 5 171 Recursive Algorithms – Topics 4 176 Program Correctness – Topics 5 177 Recursive Definitions and Structural Induction – Topics 5 178 End-of-Chapter Material 189 The Basics of Counting – Topics 6 180 The Pigeonhole Principle – Topics 3 181 Permutations and Combinations – Topics 3 182 Generalized Permutations and Identities – Topics 3 183 Permutations and Combinations – Topics 5 184 Generalized Permutations and Combinations – Topics 5 185 Generalized Permutations and Combinations – Topics 5 189 Generating Permutations and Combinations – Topics 5		
79 Set Operations – Topics 5 85 Functions – Topics 6 90 Sequences and Summations – Topics 5 93 Cardinality of Sets – Topics 3 97 Matrices – Topics 4 End-of-Chapter Material Algorithms 103 Algorithms – Topics 6 108 The Growth of Functions – Topics 5 113 Complexity of Algorithms – Topics 5 114 Number Theory and Cryptography 118 Divisibility and Modular Arithmetic – Topics 5 122 Integer Representations and Algorithms – Topics 4 130 Primes and Greatest Common Divisors – Topics 8 137 Solving Congruencies – Topics 7 140 Applications of Congruencies – Topics 3 149 Cryptography – Topics 9 End-of-Chapter Material Induction and Recursion 157 Mathematical Induction – Topics 8 162 Strong Induction and Well-Ordering – Topics 5 167 Recursive Definitions and Structural Induction – Topics 5 168 Program Correctness – Topics 5 171 Recursive Algorithms – Topics 4 176 Program Correctness – Topics 5 171 Recursive Algorithms – Topics 5 172 End-of-Chapter Material 173 The Basics of Counting – Topics 5 174 The Basics of Counting – Topics 5 175 The Pigeonhole Principle – Topics 3 186 Permutations and Combinations – Topics 3 187 Binominal Coefficients and Identities – Topics 3 188 Permutations and Combinations – Topics 5 199 Generating Permutations and Combinations – Topics 5		
85 Functions – Topics 6 90 Sequences and Summations – Topics 5 93 Cardinality of Sets – Topics 3 97 Matrices – Topics 4 End-of-Chapter Material Algorithms 103 Algorithms – Topics 6 108 The Growth of Functions – Topics 5 113 Complexity of Algorithms – Topics 5 End-of-Chapter Material Number Theory and Cryptography 118 Divisibility and Modular Arithmetic – Topics 5 122 Integer Representations and Algorithms – Topics 4 130 Primes and Greatest Common Divisors – Topics 8 137 Solving Congruencies – Topics 7 140 Applications of Congruencies – Topics 3 149 Cryptography – Topics 9 End-of-Chapter Material Induction and Recursion 157 Mathematical Induction – Topics 8 162 Strong Induction and Well-Ordering – Topics 5 163 Recursive Definitions and Structural Induction – Topics 5 171 Recursive Algorithms – Topics 4 176 Program Correctness – Topics 5 End-of-Chapter Material Counting 182 The Basics of Counting – Topics 6 185 The Pigeonhole Principle – Topics 3 188 Permutations and Combinations – Topics 5 199 Generaling Permutations and Combinations – Topics 5		
90 Sequences and Summations – Topics 5 93 Cardinality of Sets – Topics 3 97 Matrices – Topics 4 End-of-Chapter Material Algorithms 103 Algorithms – Topics 6 108 The Growth of Functions – Topics 5 113 Complexity of Algorithms – Topics 5 End-of-Chapter Material Number Theory and Cryptography 118 Divisibility and Modular Arithmetic – Topics 5 122 Integer Representations and Algorithms – Topics 4 130 Primes and Greatest Common Divisors – Topics 8 137 Solving Congruencies – Topics 7 140 Applications of Congruencies – Topics 3 149 Cryptography – Topics 9 End-of-Chapter Material Induction and Recursion 157 Mathematical Induction – Topics 8 162 Strong Induction and Well-Ordering – Topics 5 167 Recursive Definitions and Structural Induction – Topics 5 168 Program Correctness – Topics 4 176 Program Correctness – Topics 4 176 Program Correctness – Topics 5 End-of-Chapter Material Counting 182 The Basics of Counting – Topics 6 185 The Pigeonhole Principle – Topics 3 188 Permutations and Combinations – Topics 5 199 Generaliged Permutations and Combinations – Topics 5		
93 Cardinality of Sets – Topics 3 97 Matrices – Topics 4 End-of-Chapter Material Algorithms 103 Algorithms – Topics 6 108 The Growth of Functions – Topics 5 113 Complexity of Algorithms – Topics 5 End-of-Chapter Material Number Theory and Cryptography 118 Divisibility and Modular Arithmetic – Topics 5 122 Integer Representations and Algorithms – Topics 4 130 Primes and Greatest Common Divisors – Topics 8 137 Solving Congruencies – Topics 7 140 Applications of Congruencies – Topics 3 149 Cryptography – Topics 9 End-of-Chapter Material Induction and Recursion Mathematical Induction – Topics 8 162 Strong Induction and Well-Ordering – Topics 5 167 Recursive Definitions and Structural Induction – Topics 5 168 Program Correctness – Topics 4 176 Program Correctness – Topics 5 End-of-Chapter Material Counting 182 The Basics of Counting – Topics 6 185 The Pigeonhole Principle – Topics 3 196 Generalized Permutations and Combinations – Topics 5 199 Generating Permutations and Combinations – Topics 5		
97 Matrices – Topics 4 End-of-Chapter Material Algorithms 103 Algorithms – Topics 6 108 The Growth of Functions – Topics 5 113 Complexity of Algorithms – Topics 5 End-of-Chapter Material Number Theory and Cryptography 118 Divisibility and Modular Arithmetic – Topics 5 122 Integer Representations and Algorithms – Topics 4 130 Primes and Greatest Common Divisors – Topics 8 137 Solving Congruencies – Topics 7 140 Applications of Congruencies – Topics 3 149 Cryptography – Topics 9 End-of-Chapter Material Induction and Recursion 157 Mathematical Induction – Topics 8 162 Strong Induction and Well-Ordering – Topics 5 167 Recursive Definitions and Structural Induction – Topics 5 171 Recursive Algorithms – Topics 4 176 Program Correctness – Topics 5 End-of-Chapter Material Counting 182 The Basics of Counting – Topics 6 185 The Pigeonhole Principle – Topics 3 188 Permutations and Combinations – Topics 3 196 Generalized Permutations and Combinations – Topics 5 199 Generating Permutations and Combinations – Topics 5		
End-of-Chapter Material Algorithms 103 Algorithms – Topics 6 108 The Growth of Functions – Topics 5 113 Complexity of Algorithms – Topics 5 End-of-Chapter Material Number Theory and Cryptography 118 Divisibility and Modular Arithmetic – Topics 5 122 Integer Representations and Algorithms – Topics 4 130 Primes and Greatest Common Divisors – Topics 8 137 Solving Congruencies – Topics 7 140 Applications of Congruencies – Topics 3 149 Cryptography – Topics 9 End-of-Chapter Material Induction and Recursion 157 Mathematical Induction – Topics 8 162 Strong Induction and Well-Ordering – Topics 5 167 Recursive Definitions and Structural Induction – Topics 5 171 Recursive Algorithms – Topics 4 176 Program Correctness – Topics 5 End-of-Chapter Material Counting 182 The Basics of Counting – Topics 6 185 The Pigeonhole Principle – Topics 3 188 Permutations and Combinations – Topics 3 191 Binominal Coefficients and Identities – Topics 5 196 Generalized Permutations and Combinations – Topics 5 197 Generating Permutations and Combinations – Topics 5		·
Algorithms 103 Algorithms – Topics 6 108 The Growth of Functions – Topics 5 113 Complexity of Algorithms – Topics 5 End-of-Chapter Material Number Theory and Cryptography 118 Divisibility and Modular Arithmetic – Topics 5 122 Integer Representations and Algorithms – Topics 4 130 Primes and Greatest Common Divisors – Topics 8 137 Solving Congruencies – Topics 7 140 Applications of Congruencies – Topics 3 149 Cryptography – Topics 9 End-of-Chapter Material Induction and Recursion 157 Mathematical Induction – Topics 8 162 Strong Induction and Well-Ordering – Topics 5 167 Recursive Definitions and Structural Induction – Topics 5 171 Recursive Algorithms – Topics 4 176 Program Correctness – Topics 5 End-of-Chapter Material Counting 182 The Basics of Counting – Topics 6 185 The Pigeonhole Principle – Topics 3 196 Generalized Permutations and Combinations – Topics 5 199 Generating Permutations and Combinations – Topics 5	97	
103 Algorithms – Topics 6 108 The Growth of Functions – Topics 5 113 Complexity of Algorithms – Topics 5 End-of-Chapter Material Number Theory and Cryptography 118 Divisibility and Modular Arithmetic – Topics 5 122 Integer Representations and Algorithms – Topics 4 130 Primes and Greatest Common Divisors – Topics 8 137 Solving Congruencies – Topics 7 140 Applications of Congruencies – Topics 3 149 Cryptography – Topics 9 End-of-Chapter Material Induction and Recursion 157 Mathematical Induction – Topics 8 162 Strong Induction and Well-Ordering – Topics 5 167 Recursive Definitions and Structural Induction – Topics 5 171 Recursive Algorithms – Topics 4 176 Program Correctness – Topics 5 End-of-Chapter Material Counting 182 The Basics of Counting – Topics 6 185 The Pigeonhole Principle – Topics 3 186 Permutations and Combinations – Topics 3 197 Generalized Permutations and Combinations – Topics 5 198 Generalized Permutations and Combinations – Topics 5		,
108 The Growth of Functions – Topics 5 113 Complexity of Algorithms – Topics 5 End-of-Chapter Material Number Theory and Cryptography 118 Divisibility and Modular Arithmetic – Topics 5 122 Integer Representations and Algorithms – Topics 4 130 Primes and Greatest Common Divisors – Topics 8 137 Solving Congruencies – Topics 7 140 Applications of Congruencies – Topics 3 149 Cryptography – Topics 9 End-of-Chapter Material Induction and Recursion 157 Mathematical Induction – Topics 8 162 Strong Induction and Well-Ordering – Topics 5 167 Recursive Definitions and Structural Induction – Topics 5 171 Recursive Algorithms – Topics 4 176 Program Correctness – Topics 5 End-of-Chapter Material Counting 182 The Basics of Counting – Topics 6 185 The Pigeonhole Principle – Topics 3 196 Generalized Permutations and Combinations – Topics 5 199 Generating Permutations and Combinations – Topics 5		
113 Complexity of Algorithms – Topics 5 End-of-Chapter Material Number Theory and Cryptography 118 Divisibility and Modular Arithmetic – Topics 5 122 Integer Representations and Algorithms – Topics 4 130 Primes and Greatest Common Divisors – Topics 8 137 Solving Congruencies – Topics 7 140 Applications of Congruencies – Topics 3 149 Cryptography – Topics 9 End-of-Chapter Material Induction and Recursion 157 Mathematical Induction – Topics 8 162 Strong Induction and Well-Ordering – Topics 5 167 Recursive Definitions and Structural Induction – Topics 5 171 Recursive Algorithms – Topics 4 176 Program Correctness – Topics 5 End-of-Chapter Material Counting 182 The Basics of Counting – Topics 6 185 The Pigeonhole Principle – Topics 3 188 Permutations and Combinations – Topics 3 191 Binominal Coefficients and Identities – Topics 5 199 Generating Permutations and Combinations – Topics 5		
End-of-Chapter Material Number Theory and Cryptography 118 Divisibility and Modular Arithmetic – Topics 5 122 Integer Representations and Algorithms – Topics 4 130 Primes and Greatest Common Divisors – Topics 8 137 Solving Congruencies – Topics 7 140 Applications of Congruencies – Topics 3 149 Cryptography – Topics 9 End-of-Chapter Material Induction and Recursion 157 Mathematical Induction – Topics 8 162 Strong Induction and Well-Ordering – Topics 5 167 Recursive Definitions and Structural Induction – Topics 5 171 Recursive Algorithms – Topics 4 176 Program Correctness – Topics 5 End-of-Chapter Material Counting 182 The Basics of Counting – Topics 6 185 The Pigeonhole Principle – Topics 3 198 Permutations and Combinations – Topics 3 199 Generalized Permutations and Combinations – Topics 5 199 Generating Permutations and Combinations – Topics 5		
Number Theory and Cryptography 118 Divisibility and Modular Arithmetic – Topics 5 122 Integer Representations and Algorithms – Topics 4 130 Primes and Greatest Common Divisors – Topics 8 137 Solving Congruencies – Topics 7 140 Applications of Congruencies – Topics 3 149 Cryptography – Topics 9 End-of-Chapter Material Induction and Recursion 157 Mathematical Induction – Topics 8 162 Strong Induction and Well-Ordering – Topics 5 167 Recursive Definitions and Structural Induction – Topics 5 171 Recursive Algorithms – Topics 4 176 Program Correctness – Topics 5 End-of-Chapter Material Counting 182 The Basics of Counting – Topics 6 185 The Pigeonhole Principle – Topics 3 191 Binominal Coefficients and Identities – Topics 3 192 Generalized Permutations and Combinations – Topics 5 193 Generating Permutations and Combinations – Topics 5	113	
118 Divisibility and Modular Arithmetic – Topics 5 122 Integer Representations and Algorithms – Topics 4 130 Primes and Greatest Common Divisors – Topics 8 137 Solving Congruencies – Topics 7 140 Applications of Congruencies – Topics 3 149 Cryptography – Topics 9 End-of-Chapter Material Induction and Recursion 157 Mathematical Induction – Topics 8 162 Strong Induction and Well-Ordering – Topics 5 167 Recursive Definitions and Structural Induction – Topics 5 171 Recursive Algorithms – Topics 4 176 Program Correctness – Topics 5 End-of-Chapter Material Counting 182 The Basics of Counting – Topics 6 185 The Pigeonhole Principle – Topics 3 188 Permutations and Combinations – Topics 3 191 Binominal Coefficients and Identities – Topics 5 199 Generalized Permutations and Combinations – Topics 5		,
122 Integer Representations and Algorithms – Topics 4 130 Primes and Greatest Common Divisors – Topics 8 137 Solving Congruencies – Topics 7 140 Applications of Congruencies – Topics 3 149 Cryptography – Topics 9 End-of-Chapter Material Induction and Recursion 157 Mathematical Induction – Topics 8 162 Strong Induction and Well-Ordering – Topics 5 167 Recursive Definitions and Structural Induction – Topics 5 171 Recursive Algorithms – Topics 4 176 Program Correctness – Topics 5 End-of-Chapter Material Counting 182 The Basics of Counting – Topics 6 185 The Pigeonhole Principle – Topics 3 188 Permutations and Combinations – Topics 3 191 Binominal Coefficients and Identities – Topics 5 199 Generating Permutations and Combinations – Topics 5		
130 Primes and Greatest Common Divisors – Topics 8 137 Solving Congruencies – Topics 7 140 Applications of Congruencies – Topics 3 149 Cryptography – Topics 9 End-of-Chapter Material Induction and Recursion 157 Mathematical Induction – Topics 8 162 Strong Induction and Well-Ordering – Topics 5 167 Recursive Definitions and Structural Induction – Topics 5 171 Recursive Algorithms – Topics 4 176 Program Correctness – Topics 5 End-of-Chapter Material Counting 182 The Basics of Counting – Topics 6 185 The Pigeonhole Principle – Topics 3 188 Permutations and Combinations – Topics 3 191 Binominal Coefficients and Identities – Topics 5 199 Generating Permutations and Combinations – Topics 5		,
137 Solving Congruencies – Topics 7 140 Applications of Congruencies – Topics 3 149 Cryptography – Topics 9 End-of-Chapter Material Induction and Recursion 157 Mathematical Induction – Topics 8 162 Strong Induction and Well-Ordering – Topics 5 167 Recursive Definitions and Structural Induction – Topics 5 171 Recursive Algorithms – Topics 4 176 Program Correctness – Topics 5 End-of-Chapter Material Counting 182 The Basics of Counting – Topics 6 185 The Pigeonhole Principle – Topics 3 188 Permutations and Combinations – Topics 3 191 Binominal Coefficients and Identities – Topics 3 196 Generalized Permutations and Combinations – Topics 5 199 Generating Permutations and Combinations – Topics 3		
140 Applications of Congruencies – Topics 3 149 Cryptography – Topics 9 End-of-Chapter Material Induction and Recursion 157 Mathematical Induction – Topics 8 162 Strong Induction and Well-Ordering – Topics 5 167 Recursive Definitions and Structural Induction – Topics 5 171 Recursive Algorithms – Topics 4 176 Program Correctness – Topics 5 End-of-Chapter Material Counting 182 The Basics of Counting – Topics 6 185 The Pigeonhole Principle – Topics 3 198 Permutations and Combinations – Topics 3 191 Binominal Coefficients and Identities – Topics 3 196 Generalized Permutations and Combinations – Topics 5 199 Generating Permutations and Combinations – Topics 3		
149 Cryptography – Topics 9 End-of-Chapter Material Induction and Recursion 157 Mathematical Induction – Topics 8 162 Strong Induction and Well-Ordering – Topics 5 167 Recursive Definitions and Structural Induction – Topics 5 171 Recursive Algorithms – Topics 4 176 Program Correctness – Topics 5 End-of-Chapter Material Counting 182 The Basics of Counting – Topics 6 185 The Pigeonhole Principle – Topics 3 188 Permutations and Combinations – Topics 3 191 Binominal Coefficients and Identities – Topics 3 196 Generalized Permutations and Combinations – Topics 5 199 Generating Permutations and Combinations – Topics 3		<u> </u>
End-of-Chapter Material Induction and Recursion 157 Mathematical Induction – Topics 8 162 Strong Induction and Well-Ordering – Topics 5 167 Recursive Definitions and Structural Induction – Topics 5 171 Recursive Algorithms – Topics 4 176 Program Correctness – Topics 5 End-of-Chapter Material Counting 182 The Basics of Counting – Topics 6 185 The Pigeonhole Principle – Topics 3 188 Permutations and Combinations – Topics 3 191 Binominal Coefficients and Identities – Topics 3 196 Generalized Permutations and Combinations – Topics 5 199 Generating Permutations and Combinations – Topics 3		
Induction and Recursion 157 Mathematical Induction – Topics 8 162 Strong Induction and Well-Ordering – Topics 5 167 Recursive Definitions and Structural Induction – Topics 5 171 Recursive Algorithms – Topics 4 176 Program Correctness – Topics 5 End-of-Chapter Material Counting 182 The Basics of Counting – Topics 6 185 The Pigeonhole Principle – Topics 3 188 Permutations and Combinations – Topics 3 191 Binominal Coefficients and Identities – Topics 3 196 Generalized Permutations and Combinations – Topics 5 199 Generating Permutations and Combinations – Topics 3	149	7, 5, 7
157 Mathematical Induction – Topics 8 162 Strong Induction and Well-Ordering – Topics 5 167 Recursive Definitions and Structural Induction – Topics 5 171 Recursive Algorithms – Topics 4 176 Program Correctness – Topics 5 End-of-Chapter Material Counting 182 The Basics of Counting – Topics 6 185 The Pigeonhole Principle – Topics 3 188 Permutations and Combinations – Topics 3 191 Binominal Coefficients and Identities – Topics 3 196 Generalized Permutations and Combinations – Topics 5 199 Generating Permutations and Combinations – Topics 3		
162 Strong Induction and Well-Ordering – Topics 5 167 Recursive Definitions and Structural Induction – Topics 5 171 Recursive Algorithms – Topics 4 176 Program Correctness – Topics 5 End-of-Chapter Material Counting 182 The Basics of Counting – Topics 6 185 The Pigeonhole Principle – Topics 3 188 Permutations and Combinations – Topics 3 191 Binominal Coefficients and Identities – Topics 3 196 Generalized Permutations and Combinations – Topics 5 199 Generating Permutations and Combinations – Topics 3		
167 Recursive Definitions and Structural Induction – Topics 5 171 Recursive Algorithms – Topics 4 176 Program Correctness – Topics 5 End-of-Chapter Material Counting 182 The Basics of Counting – Topics 6 185 The Pigeonhole Principle – Topics 3 188 Permutations and Combinations – Topics 3 191 Binominal Coefficients and Identities – Topics 3 196 Generalized Permutations and Combinations – Topics 5 199 Generating Permutations and Combinations – Topics 3		Mathematical Induction – Topics 8
171 Recursive Algorithms – Topics 4 176 Program Correctness – Topics 5 End-of-Chapter Material Counting 182 The Basics of Counting – Topics 6 185 The Pigeonhole Principle – Topics 3 188 Permutations and Combinations – Topics 3 191 Binominal Coefficients and Identities – Topics 3 196 Generalized Permutations and Combinations – Topics 5 199 Generating Permutations and Combinations – Topics 3	162	Strong Induction and Well-Ordering – Topics 5
176 Program Correctness – Topics 5 End-of-Chapter Material Counting 182 The Basics of Counting – Topics 6 185 The Pigeonhole Principle – Topics 3 188 Permutations and Combinations – Topics 3 191 Binominal Coefficients and Identities – Topics 3 196 Generalized Permutations and Combinations – Topics 5 199 Generating Permutations and Combinations – Topics 3	167	· ·
End-of-Chapter Material Counting The Basics of Counting – Topics 6 The Pigeonhole Principle – Topics 3 Permutations and Combinations – Topics 3 Binominal Coefficients and Identities – Topics 3 Generalized Permutations and Combinations – Topics 5 Generating Permutations and Combinations – Topics 3	171	Recursive Algorithms – Topics 4
Counting The Basics of Counting – Topics 6 The Pigeonhole Principle – Topics 3 Permutations and Combinations – Topics 3 Binominal Coefficients and Identities – Topics 3 Generalized Permutations and Combinations – Topics 5 Generating Permutations and Combinations – Topics 3	176	Program Correctness – Topics 5
The Basics of Counting – Topics 6 The Pigeonhole Principle – Topics 3 Permutations and Combinations – Topics 3 Binominal Coefficients and Identities – Topics 3 Generalized Permutations and Combinations – Topics 5 Generating Permutations and Combinations – Topics 3		End-of-Chapter Material
185 The Pigeonhole Principle – Topics 3 188 Permutations and Combinations – Topics 3 191 Binominal Coefficients and Identities – Topics 3 196 Generalized Permutations and Combinations – Topics 5 199 Generating Permutations and Combinations – Topics 3		Counting
188 Permutations and Combinations – Topics 3 191 Binominal Coefficients and Identities – Topics 3 196 Generalized Permutations and Combinations – Topics 5 199 Generating Permutations and Combinations – Topics 3	182	The Basics of Counting – Topics 6
191 Binominal Coefficients and Identities – Topics 3 196 Generalized Permutations and Combinations – Topics 5 199 Generating Permutations and Combinations – Topics 3	185	The Pigeonhole Principle – Topics 3
196 Generalized Permutations and Combinations – Topics 5 199 Generating Permutations and Combinations – Topics 3	188	·
199 Generating Permutations and Combinations – Topics 3	191	Binominal Coefficients and Identities – Topics 3
	196	Generalized Permutations and Combinations – Topics 5
End of Chapter Material	199	Generating Permutations and Combinations – Topics 3
Eliu-Ol-Cilaptel Material		End-of-Chapter Material
Discrete Probability		Discrete Probability
203 An Introduction to Discrete Probability – Topics 4	203	An Introduction to Discrete Probability – Topics 4
213 Probability Theory – Topics 10	213	Probability Theory – Topics 10
216 Bayes' Theorem – Topics 3	216	Bayes' Theorem – Topics 3
224 Expected Value and Variance – Topics 8	224	Expected Value and Variance – Topics 8

	End-of-Chapter Material
	Advanced Counting Techniques
227	Applications of Recurrence Relations – Topics 3
230	Solving Linear Recurrence Relations – Topics 3
232	Divide-and-Conquer Algorithms and Recurrence Relations – Topics 2
237	Generating Functions – Topics 5
239	Inclusion-Exclusion – Topics 2
244	Applications of Inclusion-Exclusion – Topics 5
	End-of-Chapter Material
240	Relations Deletions and Their Dramatics Taxies 5
249	Relations and Their Properties – Topics 5
255	n-ary Relations and Their Applications – Topics 6
258	Representing Relations – Topics 3
263	Closures of Relations – Topics 5
267	Equivalence Relations – Topics 4
273	Partial Orderings – Topics 6
	End-of-Chapter Material
274	Graphs
274	Graphs and Graph Models – Topics 1
281	Graph Terminology and Special Types of Graphs – Topics 7
287	Representing Graphs and Graph Isomorphism – Topics 6
294	Connectivity – Topics 7
298	Euler and Hamilton Paths – Topics 4
301	Shortest-Path Problems – Topics 3
303	Planar Graphs – Topics 3
305	Graph Coloring – Topics 2
	End-of-Chapter Material
	Trees
308	Introduction to Trees – Topics 3
313	Applications of Trees – Topics 5
317	Tree Traversal – Topics 4
322	Spanning Trees – Topics 5
324	Minimum Spanning Trees – Topics 2
	End-of-Chapter Material
	Boolean Algebra
329	Boolean Functions – Topics 5
331	Representing Boolean Functions – Topics 2
335	Logic Gates – Topics 4
339	Minimization of Circuits – Topics 4
	End-of-Chapter Material
	Modeling Computation
344	Languages and Grammars – Topics 5
346	Finite-State Machines with Output – Topics 2
351	Finite-State Machines with No Output – Topics 5
356	Language Recognition – Topics 5
363	Turing Machines – Topics 7
	End-of-Chapter Material
	Appendices
	Axioms for the Real Numbers and the Positive Integers
	Exponential and Logarithmic Functions
	Pseudocode

Data Structure and Algorithm

Data Structure: Reference-1

	Front demonstrate of Data Chrostomas in C
	Fundamentals of Data Structures in C
04	Basic Concepts Out of the Control o
01	Overview: System Life Cycle
03	Algorithm Specification – Topics 2
04	Data Abstraction Taxin 1
80	Performance Analysis – Topics 4
09	Performance Measurement
	References and Selected Readings
10	Arrays and Structures
10	The Array as an Abstract Data Type
14	Structures and Unions – Topics 4
17	The Polynomial Abstract Data Type – Topics 3
18	The Representation of Multidimensional Arrays
21	The String Abstract Data Type – Topics 3
22	The Representation of Multidimensional Arrays
24	The String Abstract Data Type – Topics 2
	References and Selected Readings
	Additional Exercises
	Stacks ad Queues
25	The Sack Abstract Data Type
26	The Queue Abstract Data Type
27	A Mazing Problem
30	Evaluation of Expressions – Topics 3
31	Multiple Stacks and Queues
	Selected Readings and References
	Additional Exercises
	Lists
33	Pointers – Topics 2
34	Singly Linked Lists
35	Dynamically Linked Stacks and Queues
40	Polynomials – Topics 5
41	Equivalence Relations
42	Sparse Matrices
43	Doubly Linked Lists
	References and Selected Readings
	Additional Exercises
	Trees
45	Introduction – Topics 2
48	Binary Trees – Topics 3
49	Binary Tree Traversals
50	Additional Binary Tree Operations
51	Threaded Binary Trees
55	Heaps – Topics 4
60	Binary Search Trees – Topics 5
61	Selection Trees
63	Forests – Topics 2
65	Set Representation – Topics 2
69	Counting Binary Trees – Topics 4
	References and Selected Readings
	Additional Exercises

	Graphs
72	·
	The Graph Abstract Data Type – Topics 3
77	Elementary Graph Operations – Topics 5
78	Minimum Cost Spanning Trees
81	Shortest Paths and Transitive Closure – Topics 3
83	Activity Networks – Topics 2
	References and Selected Readings
	Additional Exercises
	Sorting
87	Searching and List Verification – Topics 4
88	Definitions
89	Insertion Sort
90	Quick Sort
91	Optimal Sorting Time
94	Merge Sort – Topics 3
95	Heap Sort
96	Radix Sort
97	List and Table Sorts
98	Summary of Internal Sorting
103	External Sorting – Topics 5
	References and Selected Readings
	Additional Exercises
	Hashing
104	The Symbol Table Abstract Data Type
108	Static Hashing – Topics 4
111	Dynamic Hashing – Topics 3
	References and Selected Readings
	Heap Structures
114	Min-Max Heaps – Topics 3
117	Deaps – Topics 3
118	Leftist Trees
124	Binomial Heaps – Topics 6
130	Fibonacci Heaps – Topics 6
100	References and Selected Readings
	Search Structures
131	Optimal Binary Search Trees
132	AVL Trees
136	2-3 Trees – Topics 4
139	2-3-4 Trees – Topics 3
144	Red-Black Trees – Topics 5
150	B-Trees – Topics 6
151	Splay Trees Digital Search Trees Tonics 2
154	Digital Search Trees – Topics 3
155	Differential Files
	References and Selected Readings

Data Structure: Reference-2

	Data Structures and Program Design in C++
	Programming Principles
01	Introduction
05	The Game of Life – Topics 4
08	Programming Style – Topics 3
16	Coding, Testing, and Further Refinement – Topics 8
19	Program Maintenance – Topics 3
23	Conclusions and Preview – Topics 4
23	Pointers and Pitfalls
	Review Questions
	References for Further Study – Topics 4
20	Introduction to Stacks
28	Stack Specifications – Topics 5
32	Implementation of Stacks – Topics 4
33	Application: A Desk Calculator
34	Application: Bracket Matching
37	Abstract Data Types and Their Implementations – Topics 3
	Pointers and Pitfalls
	Review Questions
	References for Further Study
	Queues
39	Definitions – Topics 2
40	Implementations of Queues
41	Circular Implementation of Queues in C++
42	Demonstration and Testing
49	Application of Queues: Simulation – Topics 7
	Pointers and Pitfalls
	Review Questions
	References for Further Study
	Linked Stacks and Queues
52	Pointers and Linked Structures – Topics 3
53	Linked Stacks
57	Linked Stacks with Safeguards – Topics 4
59	Linked Queues – Topics 2
65	Applications: Polynomial Arithmetic – Topics 6
66	Abstract Data Types and Their Implementations
	Pointers and Pitfalls
	Review Questions
	Recursion
70	Introduction to Recursion – Topics 4
75	Principles of Recursion – Topics 5
82	Backtracking: Postponing the Work – Topics 7
87	Tree-Structured Programs: Look-Ahead in Games – Topics 5
	Pointers and Pitfalls
	Review Questions
	References for Further Study
	Lists and Strings
88	List Definition – Topics 1
94	Implementation of Lists – Topics 6
97	Strings – Topics 3
99	Application: A Text Editor – Topics 2
100	Linked Lists in Arrays
	·

101	Application: Congrating Permutations
101	Application: Generating Permutations Reinters and Bitfalls
	Pointers and Pitfalls
	Review Questions
	References for Further Study
	Searching
102	Searching: Introduction and Notation
103	Sequential Search
107	Binary Search – Topics 4
111	Comparison Trees – Topics 4
112	Lower Bounds
116	Asymptotics – Topics 4
	Pointers and Pitfalls
	Review Questions
	References for Further Study
	Sorting
117	Introduction and Notation – Topics 1
121	Insertion Sort – Topics 4
125	Selection Sort – Topics 4
126	Shell Sort
127	Lower Bounds
129	Divide-and-Conquer Sorting – Topics 2
131	Merge-sort for Linked Lists – Topics 2
136	Quick-sort for Contiguous Lists – Topics 5
140	Heaps and Heapsort – Topics 4
141	Review: Comparison of Methods
	Pointers and Pitfalls
	Review Questions
	References for Further Study
	Tables and Information Retrieval
142	Introduction: Breaking the lg n Barrier
143	Rectangular Tables
146	Tables of Various Shapes – Topics 3
147	Tables: A New Abstract Data Type
150	Application: Radix Sort – Topics 3
154	Hashing – Topics 4
155	Analysis of Hashing
156	Conclusions: Comparison of Methods
160	Application: The Life Game Revisited – Topics 4
	Pointers and Pitfalls
	Review Questions
	References for Further Study
	Binary Trees
163	Binary Trees – Topics 3
168	Binary Search Trees – Topics 5
172	Height Balance: AVL Trees – Topics 4
177	Splay Trees: A Self-Adjusting Data Structure – Topics 5
177	Pointers and Pitfalls
	Review Questions
	References for Further Study
	Multiway Trees
183	
190	Orchards, Trees, and Binary Trees – Topics 6 Lexicographic Search Trees: Tries – Topics 7
196	External Searching: B-Trees – Topics 6
202	
202	Red-Black Trees – Topics 6
	Pointers and pitfalls

	Review Questions
	References for Further Study
	Graphs
205	Mathematical Background – Topics 3
208	Computer Representation – Topics 3
211	Graph Traversal – Topics 3
214	Topological Sorting – Topics 3
218	A Greedy Algorithm: Shortest Paths – Topics 4
222	Minimal Spanning Trees – Topics 4
223	Graphs as Data Structures
	Pointers and Pitfalls
	Review Questions
	References for Further Study
	Case Study: The Polish Notation
224	The Problem – Topics 1
225	The Idea – Topics 2
131	Evaluation of Polish Expressions – Topics 6
132	Translation from Infix From to Polish Form
140	An Interactive Expression Evaluator – Topics 8
	Appendix: Mathematical Methods
141	Sums of Powers of Integers
149	Logarithms – Topics 8
152	Permutations Combinations, Factorials – Topics 3
153	Fibonacci Numbers
157	Catalan Numbers – Topics 4
	References for Further Study
	Appendix: Random Numbers
158	Introduction
159	Strategy
160	Program Development
	References for Further Study
	Packages and Utility Functions
161	Packages and C++ Translation Units
162	Packages in the Text
163	The Utility Package
164	Timing Methods
104	Programming Precepts, Pointer and Pitfalls
172	Choice of Data Structures and Algorithms – Topics 8
173	Recursion
174	Design of Data Structures
175	Algorithm Design and Analysis
176	Programming with Pointer Objects
177	Debugging and Testing
178	Maintenance

Algorithm: Reference-1

	Computer Algorithms
	Introduction
01	What is an Algorithm?
03	Algorithm Specification – Topics 2
08	Performance Analysis – Topics 5
13	Randomized Algorithms – Topics 5
13	References and readings
	Elementary Data Structures
14	Stacks and Queues
16	Trees – Topics 2
18	Dictionaries – Topics 2
20	Priority Queues – Topics 2
22	Sets and Disjoint Set Union – Topics 2
25	Graphs – Topics 3
23	References and Readings
	Divide-and-Conquer
26	General Method
27	Binary Search Finding the Maximum and Minimum
28	Finding the Maximum and Minimum Marga Sort
31	Merge Sort
33	Quick Sort – Topics 2
34	Selection – Topics 2
	Strassen's Matrix Multiplication
38	Convex Hull – Topics 4
	References and Readings
	Additional Exercises
20	The Greedy Method
39	The General Method
40	Knapsack Problem
41	Tree Vertex Splitting
45	Job Sequencing with Deadlines
48	Minimum-Cost Spanning Trees – Topics 3
49	Optimal Storage on Tapes
50	Optimal Merge Patterns
51	Single-Source Shortest Paths
	References and Readings
	Additional Exercises
50	Dynamic Programming The Control Mathematical Adults of the Control
52	The General Method
53	Multistage Graphs
54	All Pairs Shortest Paths General Weights
55	Optimal Binary Search Trees
56	String Editing
57	0/1-Knapsack
58	Reliability Design
59	The Traveling Salesperson Problem
60	Flow Shop Scheduling
	References and Readings
	Additional Exercises
-	Basic Traversal and Search Techniques
61	Techniques for Binary Trees
63	Techniques for Graphs – Topics 2

64	Connected Components and Spanning Trees
65	Connected Components and Spanning Trees
05	Bi-connected Components and DFS
	References and Readings
	Backtracking
66	The General Method
67	The 8-Queens Problem
68	Sum of Subsets
69	Graph Coloring
70	Hamiltonian Cycles
71	Knapsack Problem
	References and Readings
	Additional Exercises
	Branch-and-Bound
77	The Method – Topics 6
79	0/1 Knapsack Problem – Topics 2
80	Traveling Salesperson
81	Efficiency Considerations
	References and Readings
	Algebraic Problems
82	The General Method
83	Evaluation and Interpolation
85	The Fast Fourier Transform – Topics 2
86	Modular Arithmetic
87	Even Faster Evaluation and Interpolation
67	References and Readings
	Lower Bound Theory
90	·
	Comparison Trees – Topics 3
94	Oracles and Adversary Arguments – Topics 4
100	Lower Bonds Through Reductions – Topics 6
101	Techniques for Algebraic Problems
	References and Readings
100	NP-Hard and NP-Complete Problems
103	Basic Concepts – Topics 2
104	Cook's Theorem
110	NP-Hard Graph Problems – Topics 6
113	NP-Hard Scheduling Problems – Topics 3
115	NP-Hard Code Generation Problems – Topics 2
116	Some Simplified NP-Hard Problems
	References and Readings
	Approximation Algorithms
117	Introduction
120	Absolute Approximations – Topics 3
123	e-Approximations – Topics 3
125	Polynomial Time Approximation Schemes – Topics 2
128	Fully Polynomial Time Approximation Schemes – Topics 3
129	Probabilistically Good Algorithms
	References and Readings
	Additional Exercises
	Pram Algorithms
130	Introduction
131	Computational Model
133	Fundamental Techniques and Algorithms – Topics 2
138	Selection – Topics 5
142	Merging – Topics 4
146	Sorting – Topics 4
± 10	

148	Graph Problems – Topics 2
149	Computing the Convex Hull
151	Lower Bounds – Topics 2
	References and Readings
	Additional Exercises
	Mesh Algorithms
152	Computational Model
155	Packet Routing – Topics 3
159	Fundamental Algorithms – Topics 4
162	Selection – Topics 3
165	Merging – Topics 3
167	Sorting – Topics 2
169	Graph Problems – Topics 2
170	Computing the Convex Hull
	References and Readings
	Additional Exercises
	Hypercube Algorithms
173	Computational Model – Topics 3
175	PPR Routing – Topics 2
179	Fundamental Algorithms – Topics 4
182	Selection – Topics 3
184	Merging – Topics 2
186	Sorting – Topics 2
187	Graph Problems
188	Computing the Convex Hull
	References and Readings
	Additional Exercises
186 187	Sorting – Topics 2 Graph Problems Computing the Convex Hull

Algorithm: Reference-2

Part-1: Foundations O2 The Role of Algorithms in Computing – Topics 2 O5 Getting Started – Topics 3 O7 Growth of Functions – Topics 2 13 Divide-and-Conquer – Topics 6 17 Probabilistic Analysis and Randomized Algorithms – Topics 4 Part-2: Sorting and Order Statistic 22 Heapsort – Topics 5 26 Quicksort – Topics 4 30 Sorting in Linear Time – Topics 4 31 Medians and Order Statistics – Topics 3 Part-3: Data Structures 18 Elementary Data Structures 19 Elementary Data Structures – Topics 4 42 Hash Tables – Topics 5 43 Augmenting Data Structures – Topics 4 50 Red-Black Trees – Topics 4 51 Augmenting Data Structures – Topics 3 Part-4: Advanced Design and Analysis Techniques D8 Dynamic Programming – Topics 5 67 Amortized Analysis – Topics 5 67 Amortized Analysis – Topics 4 Part-5: Advanced Data Structure 70 B-Trees – Topics 3 17 Fibonacci Heaps – Topics 4 Part-5: Graph Algorithms – Topics 5 88 Minimum Spanning Trees – Topics 3 86 Elementary Graph Algorithms – Topics 5 87 Minimum Spanning Trees – Topics 3 88 Minimum Spanning Trees – Topics 3 10 Maximum Flow – Topics 5 104 Multithreaded Algorithms – Topics 5 105 Part-7: Selected Topics 106 Maximum Flow – Topics 3 107 Matrix Operations – Topics 3 110 Maximum Flow – Topics 3 111 Linear Programming – Topics 3 112 Linear Programming – Topics 4 113 Opynomination Algorithms – Topics 9 114 Approximation Algorithms – Topics 5 115 Opynomination Algorithms – Topics 5 116 Approximation Algorithms – Topics 5 117 NP-Completeness – Topics 4 118 Approximation Algorithms – Topics 5		Introduction to Algorithm
The Role of Algorithms in Computing — Topics 2		
05 Getting Started – Topics 3 07 Growth of Functions – Topics 2 13 Divide-and-Conquer – Topics 6 17 Probabilistic Analysis and Randomized Algorithms – Topics 4 Part-2: Sorting and Order Statistic 22 Heapsort – Topics 4 30 Sorting in Linear Time – Topics 4 31 Medians and Order Statistics – Topics 3 32 Part-3: Data Structures 33 Elementary Data Structures – Topics 4 44 Hash Tables – Topics 5 46 Binary Search Trees – Topics 4 47 Hash Tables – Topics 5 48 Augmenting Data Structures – Topics 4 49 Hash Tables – Topics 5 40 Red-Black Trees – Topics 4 40 Red-Black Trees – Topics 4 41 Augmenting Data Structures – Topics 3 42 Part-4: Advanced Design and Analysis Techniques 43 Dynamic Programming – Topics 5 44 Part-5: Advanced Data Structure 45 Amortized Analysis – Topics 4 46 Part-5: Advanced Data Structure 47 Part-5: Advanced Data Structure 48 Part-5: Advanced Data Structure 49 B-Trees – Topics 3 40 Part-6: Advanced Data Structure 40 B-Trees – Topics 3 41 Data Structures for Disjoint Sets – Topics 4 42 Part-6: Graph Algorithms 43 Data Structures for Disjoint Sets – Topics 4 44 Part-6: Graph Algorithms 45 Elementary Graph Algorithms 46 Elementary Graph Algorithms – Topics 5 47 All-Pairs Shortest Paths – Topics 5 48 Minimum Spanning Trees – Topics 3 49 All-Pairs Shortest Paths – Topics 5 40 All-Pairs Shortest Paths – Topics 5 41 Maximum Flow – Topics 5 42 Part-7: Selected Topics 43 Matrix Operations – Topics 3 44 Linear Programming – Topics 3 45 Part-7: Getter Topics 3 46 Part-7: Advanced Data Structure 5 47 Part-8: Advanced Data Structure 5 48 Part-9: Advanced Data Structure 6 49 String Matching – Topics 3 40 Augmentina Algorithms – Topics 5 40 Part-7: Getter Topics 4 41 Part-8: Advanced Data Structure 7 41 Part-8: Advanced Data Structure 7 41 Part-8: Advanced Data Structure 7 42 Linear Programming – Topics 5 43 Part-9: Advanced Data Structure 7 44 Part-8: Advanced Data Structure 7 45 Part-8: Advanced Data Structure 7 46 Part-8: Advanced Data Structure 7 47 Part Part Part Part Part Part Part Part	02	
07 Growth of Functions – Topics 2 13 Divide-and-Conquer – Topics 6 17 Probabilistic Analysis and Randomized Algorithms – Topics 4 Part-2: Sorting and Order Statistic 22 Heapsort – Topics 5 26 Quicksort – Topics 4 30 Sorting in Linear Time – Topics 4 33 Medians and Order Statistics – Topics 3 Part-3: Data Structures 18 Elementary Data Structures – Topics 4 42 Hash Tables – Topics 5 46 Binary Search Trees – Topics 4 50 Red-Black Trees – Topics 4 51 Augmenting Data Structures – Topics 3 Part-4: Advanced Design and Analysis Techniques 52 Dynamic Programming – Topics 5 53 Augmenting Data Structures – Topics 5 64 Greedy Algorithms – Topics 5 65 Greedy Algorithms – Topics 5 66 Amortized Analysis – Topics 4 Part-5: Advanced Data Structure 70 B-Trees – Topics 3 81 Data Structures or Disjoint Sets – Topics 4 Part-6: Graph Algorithms 86 Elementary Graph Algorithms – Topics 5 87 Minimum Spanning Trees – Topics 5 88 Minimum Spanning Trees – Topics 2 93 Single-Source Shortest Paths – Topics 5 94 All-Pairs Shortest Paths – Topics 3 101 Maximum Flow – Topics 5 102 Multithreaded Algorithm – Topics 3 103 Matrix Operations – Topics 5 104 Multithreaded Algorithm – Topics 5 105 Polynomials and the FFT – Topics 9 128 String Matching – Topics 5 129 Approximation Algorithms – Topics 5 130 Computational Geometry – Topics 5 140 Approximation Algorithms – Topics 5 141 Approximation Algorithms – Topics 5		
13 Divide-and-Conquer – Topics 6 17 Probabilistic Analysis and Randomized Algorithms – Topics 4 Part-2: Sorting and Order Statistic 22 Heapsort – Topics 5 26 Quicksort – Topics 4 30 Sorting in Linear Time – Topics 3 3 Medians and Order Statistics – Topics 3 Part-3: Data Structures 37 Elementary Data Structures – Topics 4 42 Hash Tables – Topics 5 46 Binary Search Trees – Topics 4 50 Red-Black Trees – Topics 4 51 Augmenting Data Structures – Topics 3 Part-4: Advanced Design and Analysis Techniques 52 Dynamic Programming – Topics 5 53 Greedy Algorithms – Topics 5 64 Part-5: Advanced Data Structure 70 B-Trees – Topics 3 71 Fibonacci Heaps – Topics 4 72 Van Emde Boas Trees – Topics 3 81 Data Structures for Disjoint Sets – Topics 4 Part-6: Graph Algorithms 86 Elementary Graph Algorithms – Topics 5 87 Amount of Part Hamber Structure 88 Minimum Spanning Trees – Topics 2 89 Single-Source Shortest Paths – Topics 5 80 All-Pairs Shortest Paths – Topics 3 101 Maximum Flow – Topics 3 102 Linear Programming – Topics 3 103 Maximum Flow – Topics 3 104 Multithreaded Algorithm – Topics 3 105 Matrix Operations – Topics 3 106 Computational Geometry – Topics 4 107 Matrix Operations – Topics 3 108 String Matching – Topics 4 109 Computational Geometry – Topics 5 110 Number-Theoretic Algorithms – Topics 5 111 Approximation Algorithms – Topics 5 112 Computational Geometry – Topics 5 113 Approximation Algorithms – Topics 5 114 Approximation Algorithms – Topics 5 115 Approximation Algorithms – Topics 5		
Part.2: Sorting and Order Statistic Part.2: Sorting and Order Statistic 22 Heapsort – Topics 5 26 Quicksort – Topics 4 30 Sorting in Linear Time – Topics 4 31 Medians and Order Statistics – Topics 3 Part.3: Data Structures 32 Elementary Data Structures – Topics 4 43 Hash Tables – Topics 5 44 Hash Tables – Topics 5 45 Binary Search Trees – Topics 4 50 Red-Black Trees – Topics 4 51 Augmenting Data Structures – Topics 3 Part.4: Advanced Design and Analysis Techniques 52 Dynamic Programming – Topics 5 53 Greedy Algorithms – Topics 5 64 Amortized Analysis – Topics 5 65 Amortized Analysis – Topics 4 70 B-Trees – Topics 3 74 Fibonacci Heaps – Topics 4 77 Van Emde Boas Trees – Topics 3 81 Data Structures for Disjoint Sets – Topics 4 Part.6: Graph Algorithms 86 Elementary Graph Algorithms – Topics 5 88 Minimum Spanning Trees – Topics 2 93 Single-Source Shortest Paths – Topics 5 94 All-Pairs Shortest Paths – Topics 3 101 Maximum Flow – Topics 5 104 Multithreaded Algorithm – Topics 3 105 Linear Programming – Topics 5 106 All-Pairs Shortest Paths – Topics 3 107 Matrix Operations – Topics 3 108 Linear Programming – Topics 5 109 Polynomials and the FFT – Topics 3 110 Linear Programming – Topics 5 121 Computational Geometry – Topics 4 122 Computational Geometry – Topics 5 123 Approximation Algorithms – Topics 5		
Part-2: Sorting and Order Statistic 22 Heapsort – Topics 5 26 Quicksort – Topics 5 26 Quicksort – Topics 4 30 Sorting in Linear Time – Topics 4 33 Medians and Order Statistics – Topics 3 Part-3: Data Structures 37 Elementary Data Structures – Topics 4 42 Hash Tables – Topics 5 46 Binary Search Trees – Topics 4 50 Red-Black Trees – Topics 4 53 Augmenting Data Structures – Topics 3 Part-4: Advanced Design and Analysis Techniques 58 Dynamic Programming – Topics 5 63 Greedy Algorithms – Topics 5 67 Amortized Analysis – Topics 4 Part-5: Advanced Data Structure 70 B-Trees – Topics 3 74 Fibonacci Heaps – Topics 4 77 Van Emde Boas Trees – Topics 3 81 Data Structures for Disjoint Sets – Topics 4 Part-6: Graph Algorithms 86 Elementary Graph Algorithms – Topics 5 88 Minimum Spanning Trees – Topics 2 93 Single-Source Shortest Paths – Topics 5 96 All-Pairs Shortest Paths – Topics 3 101 Maximum Flow – Topics 3 102 Multithreaded Algorithm – Topics 5 Part-7: Selected Topics 104 Multithreaded Algorithm – Topics 3 105 Maximum Flow – Topics 3 106 Matrix Operations – Topics 3 107 Matrix Operations – Topics 3 108 String Matching – Topics 5 109 String Matching – Topics 5 100 Number-Theoretic Algorithms – Topics 9 128 String Matching – Topics 5 129 Approximation Algorithms – Topics 5 140 Approximation Algorithms – Topics 5 141 Approximation Algorithms – Topics 5 142 Approximation Algorithms – Topics 5		·
22 Heapsort – Topics 5 26 Quicksort – Topics 4 30 Sorting in Linear Time – Topics 4 33 Medians and Order Statistics – Topics 3 Part-3: Data Structures 37 Elementary Data Structures – Topics 4 42 Hash Tables – Topics 5 46 Binary Search Trees – Topics 4 50 Red-Black Trees – Topics 4 51 Augmenting Data Structures – Topics 3 Part-4: Advanced Design and Analysis Techniques 52 Dynamic Programming – Topics 5 53 Greedy Algorithms – Topics 5 54 Amortized Analysis – Topics 4 Part-5: Advanced Data Structure 70 B-Trees – Topics 3 74 Fibonacci Heaps – Topics 3 75 Van Emde Boas Trees – Topics 3 81 Data Structures for Disjoint Sets – Topics 4 Part-6: Graph Algorithms 86 Elementary Graph Algorithms – Topics 5 87 Minimum Spanning Trees – Topics 5 88 Minimum Spanning Trees – Topics 5 89 All-Pairs Shortest Paths – Topics 5 90 All-Pairs Shortest Paths – Topics 5 91 Maximum Flow – Topics 5 92 Part-7: Selected Topics 93 Single-Source Shortest Paths – Topics 5 94 All-Pairs Paths – Topics 3 95 Part-7: Selected Topics 96 All-Pairs Programming – Topics 3 97 Matrix Operations – Topics 3 98 Multithreaded Algorithm – Topics 3 99 Matrix Operations – Topics 3 90 Matrix Operations – Topics 3 91 Linear Programming – Topics 5 91 Number-Theoretic Algorithms – Topics 9 91 String Matching – Topics 4 91 Computational Geometry – Topics 5 91 All-Pairs Shortest Paths – Topics 5	17	
26 Quicksort – Topics 4 30 Sorting in Linear Time – Topics 4 33 Medians and Order Statistics – Topics 3 Part-3: Data Structures 37 Elementary Data Structures – Topics 4 42 Hash Tables – Topics 5 46 Binary Search Trees – Topics 4 50 Red-Black Trees – Topics 4 51 Augmenting Data Structures – Topics 3 Part-4: Advanced Design and Analysis Techniques 52 Dynamic Programming – Topics 5 53 Greedy Algorithms – Topics 5 54 Amortized Analysis – Topics 4 Part-5: Advanced Data Structure 70 B-Trees – Topics 3 74 Fibonacci Heaps – Topics 4 77 Van Emde Boas Trees – Topics 3 81 Data Structures for Disjoint Sets – Topics 4 Part-6: Graph Algorithms 86 Elementary Graph Algorithms – Topics 5 88 Minimum Spanning Trees – Topics 2 93 Single-Source Shortest Paths – Topics 3 101 Maximum Flow – Topics 3 101 Maximum Flow – Topics 3 102 Linear Programming – Topics 3 103 Matrix Operations – Topics 3 104 Nultithreaded Algorithm – Topics 3 105 Matrix Operations – Topics 3 106 Nultithreaded Algorithm – Topics 3 107 Matrix Operations – Topics 3 108 String Matching – Topics 3 109 Number-Theoretic Algorithms – Topics 9 120 Computational Geometry – Topics 4 131 NP-Completeness – Topics 5 142 Approximation Algorithms – Topics 5 142 Approximation Algorithms – Topics 5	22	
30 Sorting in Linear Time – Topics 4 33 Medians and Order Statistics – Topics 3 Part-3: Data Structures 37 Elementary Data Structures – Topics 4 42 Hash Tables – Topics 5 46 Binary Search Trees – Topics 4 50 Red-Black Trees – Topics 4 53 Augmenting Data Structures – Topics 3 Part-4: Advanced Design and Analysis Techniques 58 Dynamic Programming – Topics 5 63 Greedy Algorithms – Topics 5 67 Amortized Analysis – Topics 4 Part-5: Advanced Data Structure 70 B-Trees – Topics 3 74 Fibonaci Heaps – Topics 4 77 Van Emde Boas Trees – Topics 3 81 Data Structures for Disjoint Sets – Topics 4 Part-6: Graph Algorithms 86 Elementary Graph Algorithms – Topics 5 88 Minimum Spanning Trees – Topics 2 93 Single-Source Shortest Paths – Topics 5 96 All-Pairs Shortest Paths – Topics 3 101 Maximum Flow – Topics 5 Part-7: Selected Topics 104 Multithreaded Algorithm – Topics 3 107 Matrix Operations – Topics 3 110 Linear Programming – Topics 3 111 Linear Programming – Topics 3 112 Linear Programming – Topics 5 114 Number-Theoretic Algorithms – Topics 9 115 Polynomials and the FFT – Topics 3 116 Computational Geometry – Topics 4 117 Ne-Completeness – Topics 5 118 Approximation Algorithms – Topics 5		
33 Medians and Order Statistics – Topics 3 Part-3: Data Structures 37 Elementary Data Structures – Topics 4 42 Hash Tables – Topics 5 46 Binary Search Trees – Topics 4 50 Red-Black Trees – Topics 4 51 Augmenting Data Structures – Topics 3 Part-4: Advanced Design and Analysis Techniques 52 Dynamic Programming – Topics 5 53 Greedy Algorithms – Topics 5 54 Amortized Analysis – Topics 4 Part-5: Advanced Data Structure 70 B-Trees – Topics 3 74 Fibonacci Heaps – Topics 4 77 Van Emde Boas Trees – Topics 3 81 Data Structures for Disjoint Sets – Topics 4 Part-6: Graph Algorithms 86 Elementary Graph Algorithms 87 Elementary Graph Algorithms – Topics 5 88 Minimum Spanning Trees – Topics 2 93 Single-Source Shortest Paths – Topics 5 96 All-Pairs Shortest Paths – Topics 3 101 Maximum Flow – Topics 5 Part-7: Selected Topics 104 Multithreaded Algorithm – Topics 3 105 Matrix Operations – Topics 3 106 Natrix Operations – Topics 3 107 Matrix Operations – Topics 3 108 String Matching – Topics 4 119 Computational Geometry – Topics 4 120 Computational Geometry – Topics 5 121 Computational Geometry – Topics 5 122 Approximation Algorithms – Topics 5 142 Approximation Algorithms – Topics 5		
Part-3: Data Structures 37 Elementary Data Structures – Topics 4 42 Hash Tables – Topics 5 46 Binary Search Trees – Topics 4 50 Red-Black Trees – Topics 4 51 Augmenting Data Structures – Topics 3 42 Part-4: Advanced Design and Analysis Techniques 53 Dynamic Programming – Topics 5 54 Greedy Algorithms – Topics 5 55 Greedy Algorithms – Topics 5 56 Amortized Analysis – Topics 4 57 Part-5: Advanced Data Structure 58 Part-6: Advanced Data Structure 59 B-Trees – Topics 3 50 Augmenting – Topics 4 51 Part-6: Graph Algorithms 52 Elementary Graph Algorithms 53 Elementary Graph Algorithms – Topics 5 54 Part-7: Selected Topics 55 Part-7: Selected Topics 3 56 All-Pairs Shortest Paths – Topics 3 57 All Pairs Shortest Paths – Topics 3 58 Linear Programming – Topics 3 58 Linear Programming – Topics 3 58 Polynomials and the FFT – Topics 3 58 Polynomials and the FFT – Topics 3 58 Polynomials and the FFT – Topics 3 58 String Matching – Topics 5 59 Polynomials and the FFT – Topics 3 50 Polynomials and the FFT – Topics 3 51 Polynomials and the FFT – Topics 9 51 String Matching – Topics 5 51 String Matching – Topics 5 51 Approximation Algorithms – Topics 5		
37 Elementary Data Structures – Topics 4 42 Hash Tables – Topics 5 46 Binary Search Trees – Topics 4 50 Red-Black Trees – Topics 4 53 Augmenting Data Structures – Topics 3 Part-4: Advanced Design and Analysis Techniques 58 Dynamic Programming – Topics 5 63 Greedy Algorithms – Topics 5 67 Amortized Analysis – Topics 4 Part-5: Advanced Data Structure 70 B-Trees – Topics 3 74 Fibonacci Heaps – Topics 4 77 Van Emde Boas Trees – Topics 3 81 Data Structures for Disjoint Sets – Topics 4 Part-6: Graph Algorithms 86 Elementary Graph Algorithms – Topics 5 88 Minimum Spanning Trees – Topics 2 93 Single-Source Shortest Paths – Topics 3 101 Maximum Flow – Topics 5 96 All-Pairs Shortest Paths – Topics 3 107 Matrix Operations – Topics 3 108 Multithreaded Algorithm – Topics 3 109 Matrix Operations – Topics 5 110 Linear Programming – Topics 5 111 Linear Programming – Topics 5 112 Linear Programming – Topics 5 113 Polynomials and the FFT – Topics 9 124 Number-Theoretic Algorithms – Topics 9 125 String Matching – Topics 4 137 NP-Completeness – Topics 5 142 Approximation Algorithms – Topics 5	33	
42 Hash Tables – Topics 5 46 Binary Search Trees – Topics 4 50 Red-Black Trees – Topics 4 53 Augmenting Data Structures – Topics 3 Part-4: Advanced Design and Analysis Techniques 58 Dynamic Programming – Topics 5 63 Greedy Algorithms – Topics 5 67 Amortized Analysis – Topics 4 Part-5: Advanced Data Structure 70 B-Trees – Topics 3 74 Fibonacci Heaps – Topics 4 77 Van Emde Boas Trees – Topics 3 81 Data Structures for Disjoint Sets – Topics 4 Part-6: Graph Algorithms 86 Elementary Graph Algorithms – Topics 5 88 Minimum Spanning Trees – Topics 2 93 Single-Source Shortest Paths – Topics 5 96 All-Pairs Shortest Paths – Topics 3 101 Maximum Flow – Topics 5 Part-7: Selected Topics 104 Multithreaded Algorithm – Topics 3 105 Matrix Operations – Topics 3 106 Linear Programming – Topics 5 117 Polynomials and the FFT – Topics 3 118 String Matching – Topics 5 119 String Matching – Topics 4 120 Computational Geometry – Topics 4 121 Computational Geometry – Topics 5 122 Approximation Algorithms – Topics 5	27	
46 Binary Search Trees – Topics 4 50 Red-Black Trees – Topics 4 53 Augmenting Data Structures – Topics 3 Part-4: Advanced Design and Analysis Techniques 58 Dynamic Programming – Topics 5 63 Greedy Algorithms – Topics 5 67 Amortized Analysis – Topics 4 Part-5: Advanced Data Structure 70 B-Trees – Topics 3 74 Fibonacci Heaps – Topics 4 77 Van Emde Boas Trees – Topics 3 81 Data Structures for Disjoint Sets – Topics 4 Part-6: Graph Algorithms 86 Elementary Graph Algorithms – Topics 5 88 Minimum Spanning Trees – Topics 2 93 Single-Source Shortest Paths – Topics 5 96 All-Pairs Shortest Paths – Topics 3 101 Maximum Flow – Topics 5 Part-7: Selected Topics 104 Multithreaded Algorithm – Topics 3 105 Matrix Operations – Topics 3 116 Linear Programming – Topics 5 117 Polynomials and the FFT – Topics 3 118 String Matching – Topics 9 128 String Matching – Topics 4 137 NP-Completeness – Topics 5 142 Approximation Algorithms – Topics 5		, ,
50 Red-Black Trees – Topics 4 53 Augmenting Data Structures – Topics 3 Part-4: Advanced Design and Analysis Techniques 58 Dynamic Programming – Topics 5 63 Greedy Algorithms – Topics 5 67 Amortized Analysis – Topics 4 Part-5: Advanced Data Structure 70 B-Trees – Topics 3 74 Fibonacci Heaps – Topics 4 77 Van Emde Boas Trees – Topics 3 81 Data Structures for Disjoint Sets – Topics 4 Part-6: Graph Algorithms 86 Elementary Graph Algorithms – Topics 5 88 Minimum Spanning Trees – Topics 2 93 Single-Source Shortest Paths – Topics 5 89 All-Pairs Shortest Paths – Topics 3 101 Maximum Flow – Topics 5 Part-7: Selected Topics 104 Multithreaded Algorithm – Topics 3 107 Matrix Operations – Topics 3 110 Linear Programming – Topics 5 115 Polynomials and the FFT – Topics 3 124 Number-Theoretic Algorithms – Topics 9 125 String Matching – Topics 4 137 NP-Completeness – Topics 5 142 Approximation Algorithms – Topics 5		'
Augmenting Data Structures – Topics 3 Part-4: Advanced Design and Analysis Techniques 58 Dynamic Programming – Topics 5 63 Greedy Algorithms – Topics 5 67 Amortized Analysis – Topics 4 Part-5: Advanced Data Structure 70 B-Trees – Topics 3 74 Fibonacci Heaps – Topics 4 77 Van Emde Boas Trees – Topics 3 81 Data Structures for Disjoint Sets – Topics 4 Part-6: Graph Algorithms 86 Elementary Graph Algorithms – Topics 5 88 Minimum Spanning Trees – Topics 2 93 Single-Source Shortest Paths – Topics 5 96 All-Pairs Shortest Paths – Topics 3 101 Maximum Flow – Topics 5 Part-7: Selected Topics 104 Multithreaded Algorithm – Topics 3 107 Matrix Operations – Topics 3 112 Linear Programming – Topics 5 115 Polynomials and the FFT – Topics 3 124 Number-Theoretic Algorithms – Topics 9 125 String Matching – Topics 4 137 NP-Completeness – Topics 5 142 Approximation Algorithms – Topics 5		,
Part-4: Advanced Design and Analysis Techniques 58		
58 Dynamic Programming – Topics 5 63 Greedy Algorithms – Topics 5 67 Amortized Analysis – Topics 4 Part-5: Advanced Data Structure 70 B-Trees – Topics 3 74 Fibonacci Heaps – Topics 4 77 Van Emde Boas Trees – Topics 3 81 Data Structures for Disjoint Sets – Topics 4 Part-6: Graph Algorithms 86 Elementary Graph Algorithms – Topics 5 88 Minimum Spanning Trees – Topics 2 93 Single-Source Shortest Paths – Topics 5 96 All-Pairs Shortest Paths – Topics 3 101 Maximum Flow – Topics 5 Part-7: Selected Topics 104 Multithreaded Algorithm – Topics 3 107 Matrix Operations – Topics 3 118 Linear Programming – Topics 5 119 Polynomials and the FFT – Topics 3 120 Number-Theoretic Algorithms – Topics 9 121 String Matching – Topics 4 132 Computational Geometry – Topics 5 143 NP-Completeness – Topics 5	53	
63 Greedy Algorithms – Topics 5 67 Amortized Analysis – Topics 4 Part-5: Advanced Data Structure 70 B-Trees – Topics 3 74 Fibonacci Heaps – Topics 4 77 Van Emde Boas Trees – Topics 3 81 Data Structures for Disjoint Sets – Topics 4 Part-6: Graph Algorithms 86 Elementary Graph Algorithms – Topics 5 88 Minimum Spanning Trees – Topics 2 93 Single-Source Shortest Paths – Topics 5 96 All-Pairs Shortest Paths – Topics 3 101 Maximum Flow – Topics 5 Part-7: Selected Topics 104 Multithreaded Algorithm – Topics 3 107 Matrix Operations – Topics 3 110 Linear Programming – Topics 5 115 Polynomials and the FFT – Topics 3 114 Number-Theoretic Algorithms – Topics 9 128 String Matching – Topics 4 130 Computational Geometry – Topics 5 141 Approximation Algorithms – Topics 5		
67 Amortized Analysis – Topics 4 Part-5: Advanced Data Structure 70 B-Trees – Topics 3 74 Fibonacci Heaps – Topics 4 77 Van Emde Boas Trees – Topics 3 81 Data Structures for Disjoint Sets – Topics 4 Part-6: Graph Algorithms 86 Elementary Graph Algorithms – Topics 5 88 Minimum Spanning Trees – Topics 2 93 Single-Source Shortest Paths – Topics 5 96 All-Pairs Shortest Paths – Topics 3 101 Maximum Flow – Topics 5 Part-7: Selected Topics 104 Multithreaded Algorithm – Topics 3 107 Matrix Operations – Topics 3 112 Linear Programming – Topics 5 115 Polynomials and the FFT – Topics 3 124 Number-Theoretic Algorithms – Topics 9 128 String Matching – Topics 4 130 Computational Geometry – Topics 5 141 NP-Completeness – Topics 5 142 Approximation Algorithms – Topics 5		
Part-5: Advanced Data Structure 70 B-Trees – Topics 3 74 Fibonacci Heaps – Topics 4 77 Van Emde Boas Trees – Topics 3 81 Data Structures for Disjoint Sets – Topics 4 Part-6: Graph Algorithms 86 Elementary Graph Algorithms – Topics 5 88 Minimum Spanning Trees – Topics 2 93 Single-Source Shortest Paths – Topics 5 96 All-Pairs Shortest Paths – Topics 3 101 Maximum Flow – Topics 5 Part-7: Selected Topics 104 Multithreaded Algorithm – Topics 3 107 Matrix Operations – Topics 3 112 Linear Programming – Topics 5 115 Polynomials and the FFT – Topics 3 124 Number-Theoretic Algorithms – Topics 9 128 String Matching – Topics 4 130 Computational Geometry – Topics 5 141 NP-Completeness – Topics 5 142 Approximation Algorithms – Topics 5		
70 B-Trees – Topics 3 74 Fibonacci Heaps – Topics 4 77 Van Emde Boas Trees – Topics 3 81 Data Structures for Disjoint Sets – Topics 4 Part-6: Graph Algorithms 86 Elementary Graph Algorithms – Topics 5 88 Minimum Spanning Trees – Topics 2 93 Single-Source Shortest Paths – Topics 5 96 All-Pairs Shortest Paths – Topics 3 101 Maximum Flow – Topics 5 Part-7: Selected Topics 104 Multithreaded Algorithm – Topics 3 107 Matrix Operations – Topics 3 112 Linear Programming – Topics 5 115 Polynomials and the FFT – Topics 3 114 Number-Theoretic Algorithms – Topics 9 128 String Matching – Topics 4 130 NP-Completeness – Topics 5 141 NP-Completeness – Topics 5 142 Approximation Algorithms – Topics 5	67	
74 Fibonacci Heaps – Topics 4 77 Van Emde Boas Trees – Topics 3 81 Data Structures for Disjoint Sets – Topics 4 Part-6: Graph Algorithms 86 Elementary Graph Algorithms – Topics 5 88 Minimum Spanning Trees – Topics 2 93 Single-Source Shortest Paths – Topics 5 96 All-Pairs Shortest Paths – Topics 3 101 Maximum Flow – Topics 5 Part-7: Selected Topics 104 Multithreaded Algorithm – Topics 3 107 Matrix Operations – Topics 3 112 Linear Programming – Topics 5 115 Polynomials and the FFT – Topics 3 114 Number-Theoretic Algorithms – Topics 9 128 String Matching – Topics 4 130 NP-Completeness – Topics 5 141 Approximation Algorithms – Topics 5		
77 Van Emde Boas Trees – Topics 3 81 Data Structures for Disjoint Sets – Topics 4 Part-6: Graph Algorithms 86 Elementary Graph Algorithms – Topics 5 88 Minimum Spanning Trees – Topics 2 93 Single-Source Shortest Paths – Topics 5 96 All-Pairs Shortest Paths – Topics 3 101 Maximum Flow – Topics 5 Part-7: Selected Topics 104 Multithreaded Algorithm – Topics 3 107 Matrix Operations – Topics 3 112 Linear Programming – Topics 5 115 Polynomials and the FFT – Topics 3 114 Number-Theoretic Algorithms – Topics 9 128 String Matching – Topics 4 130 Computational Geometry – Topics 5 141 Approximation Algorithms – Topics 5		
81 Data Structures for Disjoint Sets – Topics 4 Part-6: Graph Algorithms 86 Elementary Graph Algorithms – Topics 5 88 Minimum Spanning Trees – Topics 2 93 Single-Source Shortest Paths – Topics 5 96 All-Pairs Shortest Paths – Topics 3 101 Maximum Flow – Topics 5 Part-7: Selected Topics 104 Multithreaded Algorithm – Topics 3 107 Matrix Operations – Topics 3 112 Linear Programming – Topics 5 115 Polynomials and the FFT – Topics 3 124 Number-Theoretic Algorithms – Topics 9 128 String Matching – Topics 4 130 Computational Geometry – Topics 5 141 Approximation Algorithms – Topics 5		
Part-6: Graph Algorithms Elementary Graph Algorithms – Topics 5 Minimum Spanning Trees – Topics 2 Single-Source Shortest Paths – Topics 5 All-Pairs Shortest Paths – Topics 3 Maximum Flow – Topics 5 Part-7: Selected Topics Multithreaded Algorithm – Topics 3 Matrix Operations – Topics 3 Linear Programming – Topics 5 Polynomials and the FFT – Topics 3 Linear Programming – Topics 9 String Matching – Topics 4 String Matching – Topics 4 NP-Completeness – Topics 5 Approximation Algorithms – Topics 5		
86 Elementary Graph Algorithms – Topics 5 88 Minimum Spanning Trees – Topics 2 93 Single-Source Shortest Paths – Topics 5 96 All-Pairs Shortest Paths – Topics 3 101 Maximum Flow – Topics 5 Part-7: Selected Topics 104 Multithreaded Algorithm – Topics 3 107 Matrix Operations – Topics 3 112 Linear Programming – Topics 5 115 Polynomials and the FFT – Topics 3 124 Number-Theoretic Algorithms – Topics 9 128 String Matching – Topics 4 130 Computational Geometry – Topics 4 131 NP-Completeness – Topics 5 142 Approximation Algorithms – Topics 5	81	
88 Minimum Spanning Trees – Topics 2 93 Single-Source Shortest Paths – Topics 5 96 All-Pairs Shortest Paths – Topics 3 101 Maximum Flow – Topics 5 Part-7: Selected Topics 104 Multithreaded Algorithm – Topics 3 107 Matrix Operations – Topics 3 112 Linear Programming – Topics 5 115 Polynomials and the FFT – Topics 3 124 Number-Theoretic Algorithms – Topics 9 128 String Matching – Topics 4 132 Computational Geometry – Topics 5 143 Approximation Algorithms – Topics 5		
93 Single-Source Shortest Paths – Topics 5 96 All-Pairs Shortest Paths – Topics 3 101 Maximum Flow – Topics 5 Part-7: Selected Topics 104 Multithreaded Algorithm – Topics 3 107 Matrix Operations – Topics 3 112 Linear Programming – Topics 5 115 Polynomials and the FFT – Topics 3 124 Number-Theoretic Algorithms – Topics 9 128 String Matching – Topics 4 132 Computational Geometry – Topics 4 133 NP-Completeness – Topics 5 144 Approximation Algorithms – Topics 5	86	Elementary Graph Algorithms – Topics 5
96 All-Pairs Shortest Paths – Topics 3 101 Maximum Flow – Topics 5 Part-7: Selected Topics 104 Multithreaded Algorithm – Topics 3 107 Matrix Operations – Topics 3 112 Linear Programming – Topics 5 115 Polynomials and the FFT – Topics 3 124 Number-Theoretic Algorithms – Topics 9 128 String Matching – Topics 4 132 Computational Geometry – Topics 4 137 NP-Completeness – Topics 5 142 Approximation Algorithms – Topics 5	88	Minimum Spanning Trees – Topics 2
101 Maximum Flow – Topics 5 Part-7: Selected Topics 104 Multithreaded Algorithm – Topics 3 107 Matrix Operations – Topics 3 112 Linear Programming – Topics 5 115 Polynomials and the FFT – Topics 3 124 Number-Theoretic Algorithms – Topics 9 128 String Matching – Topics 4 132 Computational Geometry – Topics 4 137 NP-Completeness – Topics 5 142 Approximation Algorithms – Topics 5	93	Single-Source Shortest Paths – Topics 5
Part-7: Selected Topics 104 Multithreaded Algorithm – Topics 3 107 Matrix Operations – Topics 3 112 Linear Programming – Topics 5 115 Polynomials and the FFT – Topics 3 124 Number-Theoretic Algorithms – Topics 9 128 String Matching – Topics 4 132 Computational Geometry – Topics 4 137 NP-Completeness – Topics 5 142 Approximation Algorithms – Topics 5	96	All-Pairs Shortest Paths – Topics 3
104 Multithreaded Algorithm – Topics 3 107 Matrix Operations – Topics 3 112 Linear Programming – Topics 5 115 Polynomials and the FFT – Topics 3 124 Number-Theoretic Algorithms – Topics 9 128 String Matching – Topics 4 132 Computational Geometry – Topics 4 137 NP-Completeness – Topics 5 142 Approximation Algorithms – Topics 5	101	Maximum Flow – Topics 5
107 Matrix Operations – Topics 3 112 Linear Programming – Topics 5 115 Polynomials and the FFT – Topics 3 124 Number-Theoretic Algorithms – Topics 9 128 String Matching – Topics 4 132 Computational Geometry – Topics 4 137 NP-Completeness – Topics 5 142 Approximation Algorithms – Topics 5		Part-7: Selected Topics
112 Linear Programming – Topics 5 115 Polynomials and the FFT – Topics 3 124 Number-Theoretic Algorithms – Topics 9 128 String Matching – Topics 4 132 Computational Geometry – Topics 4 137 NP-Completeness – Topics 5 142 Approximation Algorithms – Topics 5	104	Multithreaded Algorithm – Topics 3
115 Polynomials and the FFT – Topics 3 124 Number-Theoretic Algorithms – Topics 9 128 String Matching – Topics 4 132 Computational Geometry – Topics 4 137 NP-Completeness – Topics 5 142 Approximation Algorithms – Topics 5	107	Matrix Operations – Topics 3
124 Number-Theoretic Algorithms – Topics 9 128 String Matching – Topics 4 132 Computational Geometry – Topics 4 137 NP-Completeness – Topics 5 142 Approximation Algorithms – Topics 5	112	Linear Programming – Topics 5
128 String Matching – Topics 4 132 Computational Geometry – Topics 4 137 NP-Completeness – Topics 5 142 Approximation Algorithms – Topics 5	115	Polynomials and the FFT – Topics 3
132 Computational Geometry – Topics 4 137 NP-Completeness – Topics 5 142 Approximation Algorithms – Topics 5	124	Number-Theoretic Algorithms – Topics 9
137 NP-Completeness – Topics 5 142 Approximation Algorithms – Topics 5	128	String Matching – Topics 4
142 Approximation Algorithms – Topics 5	132	Computational Geometry – Topics 4
	137	NP-Completeness – Topics 5
	142	Approximation Algorithms – Topics 5
Part-8: Appendix: Mathematical Background		Part-8: Appendix: Mathematical Background
144 Summations – Topics 2	144	
149 Sets, Etc – Topics 5		
154 Counting and Probability – Topics 5	154	
156 Matrices – Topics 2		

Algorithm: Reference-3

	The Design and Analysis of Computer Algorithms
	Models of Computation
01	Algorithms and Their Complexity
02	Random Access Machines
03	Computational Complexity of RAM Programs
04	A Stored Program Model
05	Abstractions of the RAM
06	A Primitive Model of Computation: The Turing Machine
07	Relationship Between the Turning Machine and RAM Models
08	Pidgin ALGOL – A High-Level Language
08	Design of Efficient Algorithms
09	Data Structures: Lists, Queues, and Stacks
10	Set Representations
11	Graphs
12	Trees
13	Recursion
14	Divide-and-Conquer
15	Balancing Dura maia Brancara maia a
16 17	Dynamic Programming
1/	Epilogue Sorting and Order Statistics
10	Sorting and Order Statistics The Costing Problem
18	The Sorting Problem
19	Radix Sorting
20	Sorting by Comparisons
21	Heapsort – an O(n log n) Comparison Sort
22	Quicksort – an O(n log n) Expected Time Sort
23	Order Statistics
24	Expected Time for Order Statistics
25	Data Structures for Set Manipulation Problems
25	Fundamental Operations on Sets
26	Hashing Rivers County
27	Binary Search
28	Binary Search Trees
29	Optimal Binary Search Trees
30	A Simple Disjoint-Set Union Algorithm
31	Tree Structures for the UNION-FIND Problem
32	Applications and Extensions of the UNION-FIND Algorithm
33	Balanced Tree Schemes
34	Dictionaries and Priority Queues
35	Mergeable Heaps
36	Concatenable Queues
37	Partitioning
20	Algorithms on Graphs
38	Minimum-Cost Spanning Trees
39	Depth-First Search
40	Bi-connectivity
41	Depth-First Search of a Directed Graph
42	Strong Connectivity
43	Path-Finding Problems
44	A Transitive Closure Algorithm
45	A Shortest-Path Algorithm
46	Path Problems and Matrix Multiplication

47 48	Single-Source Problems Dominators in a Directed Acyclic Graph: Putting the Concepts Together
	Dominators in a Directed Acyclic Graph. I atting the concepts rogether
	Matrix Multiplication and Related Operations
49	Basics
50	Strassen's Matrix-Multiplication Algorithm
51	Inversion of Matrices
52	LUP Decomposition of Matrices
53	Applications of LUP Decomposition
54	Boolean Matrix Multiplication
	The Fast Fourier Transform and Its Applications
55	The Discrete Fourier Transform and Its Inverse
56	The Fast Fourier Transform Algorithm
57	The FFT Using Bit Operations
58	Products of Polynomials
59	The Schonhage-Strassen Integer-multiplication Algorithm
	Integer and Polynomial Arithmetic
60	The Similarity Between Integers and Polynomials
61	Integer Multiplication and Division
62	Polynomial Multiplication and Division
63	Modular Arithmetic
64	Modular Polynomial Arithmetic and Polynomial Evaluation
65	Chinese Remaindering
66	Chinese Remaindering and Interpolation of Polynomials
67	Greatest Common Divisors and Euclid's Algorithm
68	An Asymptotically Fast Algorithm for Polynomial GCD's
69	Integer GCD's
70	Chinese Remaindering Revisited
71	Sparse Polynomials
	Pattern-Matching Algorithms
72	Finite Automata and Regular Expressions
73	Recognition of Regular Expression Patterns
74	Recognition of Substrings
75	Tow –way Deterministic Pushdown Automata
76	Position Trees and Substring Identifiers
	NP-Complete Problems
77	Nondeterministic Turing Machines
78	The Classes P and NP
79	Languages and Problems
80	NP-Completeness of the Satisfiability Problem
81	Additional NP-Complete Problems
82	Polynomial-Space-Bounded Problems
	Some Provably Intractable Problems
83	Complexity Hierarchies
84	The Space Hierarchy for Deterministic Turing Machines
85	A Problem Requiring Exponential Time and Space
86	A Non-elementary Problem
	Lower Bounds on Numbers of Arithmetic Operations
87	Fields
88	Straight-Line Code Revisited
89	A Matrix Formulation of Problems
90	A Row-Oriented Lower Bound on Multiplications
91	A Column-Oriented Lower Bound on Multiplications
92	A Row-and-Column-Oriented Bound on Multiplications
93	Preconditioning

Database Management System

	Database System Concepts
	Introduction
01	Database-System Applications
02	Purpose of Database Systems
06	
	View of Data – Topics 4
11	Database Languages – Topics 5
12	Database Design
15	Database Engine – Topics 3
16	Database and Application Architecture
18	Database Users and Administrators – Topics 2
19	History of Database System
	Summary and Exercises
	Relational Languages
20	Introduction to The Relational Model
20	Structure of Relational Databases
21	Database Schema
22	Keys D:
23	Schema Diagrams
24	Relational Query Languages
33	The Relational Algebra – Topics 9
	Summary and Exercises
	Introduction to SQL
34	Overview of the SQL Query Language
35	SQL Data Definition
36	Basic Structure of SQL Queries
41	Additional Basic Operations – Topics 5
44	Set Operations – Topics 3
45	Null Values
49	Aggregate Functions – Topics 4
57	Nested Subqueries – Topics 8
60	Modification of the Database – Topics 3
	Summary and Exercises
	Intermediate SQL
64	Join Expressions – Topics 4
68	Views – Topics 4
69	Transactions
77	Integrity Constraints – Topics 8
85	SQL Data Types and Schemas – Topics 8
86	Index Definition in SQL
93	Authorization – Topics 7
	Summary and Exercises
	Advanced SQL
97	Accessing SQL from a Programming Language – Topics 4
100	Functions and Procedures – Topics 3
103	Triggers – Topics 3
105	Recursive Queries – Topics 2
109	Advanced Aggregation Features – Topics 4
	Summary and Exercises
	Database Design
	Database Design Using the E-R Model
111	Overview of the Design Process – Topics 12
113	The Entity-Relationship Model – Topics 2

444	Consider Attack
114	Complex Attributes
115	Mapping Cardinalities
118	Primary Key – Topics 3
119	Removing Redundant Attributes in Entity Sets
125	Reducing E-R Diagrams to Relational Schemas – Topics 6
127	Extended E-R Features – Topics 2
131	Entity-Relationship Design Issues – Topics 4
133	Alternative Notations for Modeling Data – Topics 2
136	Other Aspects of Database Design – Topics 3
	Summary and Exercises
	Relational Database Design
139	Features of Good Relational Designs – Topics 3
142	Decomposition Using Functional Dependencies – Topics 3
146	Normal Forms – Topics 4
150	Functional-Dependency Theory – Topics 4
153	Algorithms for Decomposition Using Functional Dependencies – Topics 3
156	Decomposition Using Multivalued Dependencies – Topics 3
157	More Normal Forms
158	Atomic Domains and First Normal Form
162	Database-Design Process – Topics 4
163	Modeling temporal Data
	Summary and Exercises
	Application Design and Development
	Complex Data Types
167	Semi-Structured Data – Topics 4
169	Object Orientation – Topics 2
173	Textual Data – Topics 4
177	Spatial Data – Topics 4
	Summary and Exercises
	Application Development
178	Application Programs and User Interfaces
181	Web Fundamentals – Topics 3
185	Servlets – Topics 4
188	Alternative Server-Side Frameworks – Topics 3
192	Client-Side Code and Web Services – Topics 4
194	Application Architectures – Topics 2
196	Application Performance – Topics 2
103	Application Security – Topics 7
105	Encryption and Its Applications – Topics 2
	Summary and Exercises
	Big Data Analytics
	Big Data
	Motivation
	Big Data Storage Systems
	The MapReduce Paradigm
	Beyond MapReduce: Algebraic Operations
	Streaming Data
	Graph Databases
	Summary, Exercises
	Data Analytics
	Overview of Analytics
	Data Warehousing
	Online Analytical Processing
	Data Mining
	Summary, Exercises

Storage Management and Indexing
Physical Storage Systems
Overview of Physical Storage Media
Storage Interfaces Magnetic Disks
Magnetic Disks
Flash Memory
RAID
Disk-Block Access
Summary, Exercises
Data Storage Structures
Database Storage Architecture
File Organization
Organization of Records in Files
Data-Dictionary Storage
Database Buffer
Column-Oriented Storage
Storage Organization in Main-Memory Databases
Summary, Exercises
Indexing
Basic Concepts
Ordered Indices
B+ Tree Index Files
B+ Tree Extensions
Hash Indices
Multiple-Key Access
Creation of Indices
Write-Optimized Index Structures
Bitmap Indices
Indexing of Spatial and Temporal Data
Summary, Exercises
Query Procession and Optimization
Query Processing
Overview
Measures of Query Cost
Selection Operation
Sorting
Join Operation
Other Operations
Evaluation of Expressions
Query Processing in Memory
Summary, Exercises
Query Optimization
Overview
Transformation of Relational Expressions
Estimating Statistics of Expression Results
Choice of Evaluation Plans
Materialized Views
Advanced Topics in Query Optimization
Summary, Exercises
Transaction Management
Transactions
Transaction Concept
A Simple Transaction Model
Storage Structure
Transaction Atomicity and Durability
, ,

Transaction Isolation Serializability Transaction Isolation and Atomicity Transaction Isolation Levels Implementation of Isolation Levels Transactions as SQL Statements Summary, Exercises Concurrency Control Lock-Based Protocols Deadlock Handling Multiple Granularity Insert Operations, Delete Operations and Predicate Reads Timestamp-Based Protocols Validation-Based Protocols Multi-version Schemes Snapshot Isolation Weak Levels of Consistency in Practice Advanced Topics in Concurrency Control Summary, Exercises Recovery System Failure Classification Storage Recovery and Atomicity Recovery Algorithm
Transaction Isolation and Atomicity Transaction Isolation Levels Implementation of Isolation Levels Transactions as SQL Statements Summary, Exercises Concurrency Control Lock-Based Protocols Deadlock Handling Multiple Granularity Insert Operations, Delete Operations and Predicate Reads Timestamp-Based Protocols Validation-Based Protocols Multi-version Schemes Snapshot Isolation Weak Levels of Consistency in Practice Advanced Topics in Concurrency Control Summary, Exercises Recovery System Failure Classification Storage Recovery and Atomicity
Transaction Isolation Levels Implementation of Isolation Levels Transactions as SQL Statements Summary, Exercises Concurrency Control Lock-Based Protocols Deadlock Handling Multiple Granularity Insert Operations, Delete Operations and Predicate Reads Timestamp-Based Protocols Validation-Based Protocols Walit-version Schemes Snapshot Isolation Weak Levels of Consistency in Practice Advanced Topics in Concurrency Control Summary, Exercises Recovery System Failure Classification Storage Recovery and Atomicity
Implementation of Isolation Levels Transactions as SQL Statements Summary, Exercises Concurrency Control Lock-Based Protocols Deadlock Handling Multiple Granularity Insert Operations, Delete Operations and Predicate Reads Timestamp-Based Protocols Validation-Based Protocols Walidation-Based Protocols Multi-version Schemes Snapshot Isolation Weak Levels of Consistency in Practice Advanced Topics in Concurrency Control Summary, Exercises Recovery System Failure Classification Storage Recovery and Atomicity
Transactions as SQL Statements Summary, Exercises Concurrency Control Lock-Based Protocols Deadlock Handling Multiple Granularity Insert Operations, Delete Operations and Predicate Reads Timestamp-Based Protocols Validation-Based Protocols Multi-version Schemes Snapshot Isolation Weak Levels of Consistency in Practice Advanced Topics in Concurrency Control Summary, Exercises Recovery System Failure Classification Storage Recovery and Atomicity
Summary, Exercises Concurrency Control Lock-Based Protocols Deadlock Handling Multiple Granularity Insert Operations, Delete Operations and Predicate Reads Timestamp-Based Protocols Validation-Based Protocols Multi-version Schemes Snapshot Isolation Weak Levels of Consistency in Practice Advanced Topics in Concurrency Control Summary, Exercises Recovery System Failure Classification Storage Recovery and Atomicity
Concurrency Control Lock-Based Protocols Deadlock Handling Multiple Granularity Insert Operations, Delete Operations and Predicate Reads Timestamp-Based Protocols Validation-Based Protocols Multi-version Schemes Snapshot Isolation Weak Levels of Consistency in Practice Advanced Topics in Concurrency Control Summary, Exercises Recovery System Failure Classification Storage Recovery and Atomicity
Lock-Based Protocols Deadlock Handling Multiple Granularity Insert Operations, Delete Operations and Predicate Reads Timestamp-Based Protocols Validation-Based Protocols Multi-version Schemes Snapshot Isolation Weak Levels of Consistency in Practice Advanced Topics in Concurrency Control Summary, Exercises Recovery System Failure Classification Storage Recovery and Atomicity
Deadlock Handling Multiple Granularity Insert Operations, Delete Operations and Predicate Reads Timestamp-Based Protocols Validation-Based Protocols Multi-version Schemes Snapshot Isolation Weak Levels of Consistency in Practice Advanced Topics in Concurrency Control Summary, Exercises Recovery System Failure Classification Storage Recovery and Atomicity
Multiple Granularity Insert Operations, Delete Operations and Predicate Reads Timestamp-Based Protocols Validation-Based Protocols Multi-version Schemes Snapshot Isolation Weak Levels of Consistency in Practice Advanced Topics in Concurrency Control Summary, Exercises Recovery System Failure Classification Storage Recovery and Atomicity
Insert Operations, Delete Operations and Predicate Reads Timestamp-Based Protocols Validation-Based Protocols Multi-version Schemes Snapshot Isolation Weak Levels of Consistency in Practice Advanced Topics in Concurrency Control Summary, Exercises Recovery System Failure Classification Storage Recovery and Atomicity
Timestamp-Based Protocols Validation-Based Protocols Multi-version Schemes Snapshot Isolation Weak Levels of Consistency in Practice Advanced Topics in Concurrency Control Summary, Exercises Recovery System Failure Classification Storage Recovery and Atomicity
Validation-Based Protocols Multi-version Schemes Snapshot Isolation Weak Levels of Consistency in Practice Advanced Topics in Concurrency Control Summary, Exercises Recovery System Failure Classification Storage Recovery and Atomicity
Multi-version Schemes Snapshot Isolation Weak Levels of Consistency in Practice Advanced Topics in Concurrency Control Summary, Exercises Recovery System Failure Classification Storage Recovery and Atomicity
Snapshot Isolation Weak Levels of Consistency in Practice Advanced Topics in Concurrency Control Summary, Exercises Recovery System Failure Classification Storage Recovery and Atomicity
Weak Levels of Consistency in Practice Advanced Topics in Concurrency Control Summary, Exercises Recovery System Failure Classification Storage Recovery and Atomicity
Advanced Topics in Concurrency Control Summary, Exercises Recovery System Failure Classification Storage Recovery and Atomicity
Summary, Exercises Recovery System Failure Classification Storage Recovery and Atomicity
Recovery System Failure Classification Storage Recovery and Atomicity
Failure Classification Storage Recovery and Atomicity
Storage Recovery and Atomicity
Recovery and Atomicity
Recovery Algorithm
Buffer Management
Failure with Loss of Non-Volatile Storage
High Availability Using Remote Backup Systems
Early Lock Release and Logical Undo Operations
ARIES
Recovery in Main-Memory Databases
Summary, Exercises
Parallel and Distributed Databases
Database-System Architectures
Overview
Centralized Database Systems
Server System Architectures
Parallel Systems
Distributed Systems
Transaction Processing in Parallel and Distributed Systems
Cloud-Based Services
Summary, Exercises
Parallel and Distributed Storage
Overview
Data Partitioning
Dealing with Skew in Partitioning
Replication
Parallel Indexing
Distributed File Systems
Parallel Key-Value Stores
Summary, Exercises
Parallel and Distributed Query Processing
Overview
Parallel Sort
Parallel Join
Other Operations

Parallel Evaluation of Query Plans Query Optimization for Parallel Execution Parallel Processing of Streaming Data Distributed Query Processing Summary, Exercises Parallel and Distributed Transaction Processing Distributed transactions Commit Protocols Concurrency Control in Distributed Databases Replication Extended Concurrency Control Protocols Replication with Weak Degrees of Consistency Coordinator Selection Consensus in Distributed Systems Summary, Exercises Advanced Topics Advanced Indexing Techniques Bloom Filter Bloom Filter Bloom Filter Buthdides Bitmap Indices Indexing of Spatial Data Hash Indices Summary, Exercises Advanced Application Development Performance Tuning Performance Euning Performance Renchmarks Other Issues in Application Development Standardization Distributed Directory Systems Summary, Exercises Advanced Application Development Standardization Distributed Directory Systems Summary, Exercises Block-chain Databases Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Databases Oplice-Based Databases Formal Relational Otabases Information Retrieval PostgerSQL	
Query Optimization for Parallel Execution Parallel Processing of Streaming Data Distributed Query Processing Summary, Exercises Parallel and Distributed Transaction Processing Distributed transactions Commit Protocols Concurrency Control in Distributed Databases Replication Extended Concurrency Control Protocols Replication with Weak Degrees of Consistency Coordinator Selection Consensus in Distributed Systems Summary, Exercises Advanced Topics Advanced Indexing Techniques Bloom Filter Log-Structured Merge Tree and Variants Bitmap Indices Indexing of Spatial Data Hash Indices Summary, Exercises Advanced Application Development Performance Tuning Performance Benchmarks Other Issues in Application Development Standardization Distributed Directory Systems Summary, Exercises Block-chain Databases Overview Block-chain Properties Achieving Blockchain Properties Achieving Blockchain Properties Application Summary, Exercises Performance Enhancement Emerging Application Summary, Exercises Appendix: Detail Application Summary, Exercises Performance Enhancement Emerging Application Summary, Exercises Formal Relational Query Languages Advanced Relational Databases Object-Based Databases Affice Advanced Relational Databases Object-Based Databases All Information Retrieval	Parallel Evaluation of Query Plans
Distributed Query Processing Summary, Exercises Parallel and Distributed Transaction Processing Distributed transactions Commit Protocols Concurrency Control in Distributed Databases Replication Extended Concurrency Control Protocols Replication with Weak Degrees of Consistency Coordinator Selection Consensus in Distributed Systems Summary, Exercises Advanced Indexing Techniques Bloom Filter Log-Structured Merge Tree and Variants Bitmap Indices Indexing of Spatial Data Hash Indices Summary, Exercises Advanced Application Development Performance Tuning Performance Benchmarks Other Issues in Application Development Standardization Distributed Directory Systems Summary, Exercises Block-chain Databases Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Elementant Performance Emencement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Databases Design Object-Based Databases XML Information Retrieval	
Distributed Query Processing Summary, Exercises Parallel and Distributed Transaction Processing Distributed transactions Commit Protocols Concurrency Control in Distributed Databases Replication Extended Concurrency Control Protocols Replication with Weak Degrees of Consistency Coordinator Selection Consensus in Distributed Systems Summary, Exercises Advanced Indexing Techniques Bloom Filter Log-Structured Merge Tree and Variants Bitmap Indices Indexing of Spatial Data Hash Indices Summary, Exercises Advanced Application Development Performance Benchmarks Other Issues in Application Development Standardization Distributed Directory Systems Summary, Exercises Block-chain Properties Achieving Blockchain Properties Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advance Relational Databases Object-Based Databases Online Chapters Formal Relational Databases Design Object-Based Databases XML Information Retrieval	
Summary, Exercises Parallel and Distributed Transaction Processing Distributed transactions Commit Protocols Concurrency Control in Distributed Databases Replication Extended Concurrency Control Protocols Replication with Weak Degrees of Consistency Coordinator Selection Consensus in Distributed Systems Summary, Exercises Advanced Indexing Techniques Bloom Filter Log-Structured Merge Tree and Variants Bitmap Indices Indexing of Spatial Data Hash Indices Summary, Exercises Advanced Application Development Performance Tuning Performance Benchmarks Other Issues in Application Development Standardization Distributed Directory Systems Summary, Exercises Block-chain Databases Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Emancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Databases XML Information Retrieval	
Parallel and Distributed Transaction Processing Distributed transactions Commit Protocols Concurrency Control in Distributed Databases Replication Extended Concurrency Control Protocols Replication with Weak Degrees of Consistency Coordinator Selection Consensus in Distributed Systems Summary, Exercises Advanced Topics Advanced Indexing Techniques Bloom Filter Log-Structured Merge Tree and Variants Bitmap Indices Indexing of Spatial Data Hash Indices Summary, Exercises Advanced Application Development Performance Tuning Performance Benchmarks Other Issues in Application Development Standardization Distributed Directory Systems Summary, Exercises Achieving Block-chain Drabases Overview Block-chain Drabases Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Database Design Object-Based Databases XML Information Retrieval	
Distributed transactions Commit Protocols Concurrency Control in Distributed Databases Replication Extended Concurrency Control Protocols Replication with Weak Degrees of Consistency Coordinator Selection Consensus in Distributed Systems Summary, Exercises Advanced Topics Advanced Indexing Techniques Bloom Filter Log-Structured Merge Tree and Variants Bitmap Indices Indexing of Spatial Data Hash Indices Summary, Exercises Advanced Application Development Performance Benchmarks Other Issues in Application Development Standardization Distributed Directory Systems Summary, Exercises Block-chain Databases Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Databases Opiet-Based Databases Opiet-Based Databases Advanced Relational Databases Dischala Databases Opiet-Based Databases Advanced Relational Database Design Object-Based Databases XML Information Retrieval	
Commit Protocols Concurrency Control in Distributed Databases Replication Extended Concurrency Control Protocols Replication with Weak Degrees of Consistency Coordinator Selection Consensus in Distributed Systems Summary, Exercises Advanced Topics Advanced Indexing Techniques Bloom Filter Log-Structured Merge Tree and Variants Bitmap Indices Indexing of Spatial Data Hash Indices Summary, Exercises Advanced Application Development Performance Benchmarks Other Issues in Application Development Standardization Distributed Directory Systems Summary, Exercises Advanced Application Development Standardization Distributed Directory Systems Summary, Exercises Block-chain Databases Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Databases Design Object-Based Databases Advanced Relational Databases Design Object-Based Databases XML Information Retrieval	
Concurrency Control in Distributed Databases Replication Extended Concurrency Control Protocols Replication with Weak Degrees of Consistency Coordinator Selection Consensus in Distributed Systems Summary, Exercises Advanced Topics Advanced Indexing Techniques Bloom Filter Log-Structured Merge Tree and Variants Bitmap Indices Indexing of Spatial Data Hash Indices Summary, Exercises Advanced Application Development Performance Tuning Performance Benchmarks Other Issues in Application Development Standardization Distributed Directory Systems Summary, Exercises Block-chain Databases Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Databases Object-Based Databases XML Information Retrieval	Distributed transactions
Replication Extended Concurrency Control Protocols Replication with Weak Degrees of Consistency Coordinator Selection Consensus in Distributed Systems Summary, Exercises Advanced Topics Advanced Indexing Techniques Bloom Filter Log-Structured Merge Tree and Variants Bitmap Indices Indexing of Spatial Data Hash Indices Summary, Exercises Advanced Application Development Performance Tuning Performance Benchmarks Other Issues in Application Development Standardization Distributed Directory Systems Summary, Exercises Block-chain Databases Overview Block-Chain Databases Overview Block-Chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Databases XML Information Retrieval	Commit Protocols
Extended Concurrency Control Protocols Replication with Weak Degrees of Consistency Coordinator Selection Consensus in Distributed Systems Summary, Exercises Advanced Topics Advanced Indexing Techniques Bloom Filter Log-Structured Merge Tree and Variants Bitmap Indices Indexing of Spatial Data Hash Indices Summary, Exercises Advanced Application Development Performance Tuning Performance Benchmarks Other Issues in Application Development Standardization Distributed Directory Systems Summary, Exercises Block-chain Databases Overview Block-Chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Databases Object-Based Databases NML Information Retrieval	,
Replication with Weak Degrees of Consistency Coordinator Selection Consensus in Distributed Systems Summary, Exercises Advanced Topics Advanced Indexing Techniques Bloom Filter Log-Structured Merge Tree and Variants Bitmap Indices Indexing of Spatial Data Hash Indices Summary, Exercises Advanced Application Development Performance Tuning Performance Tuning Performance Benchmarks Other Issues in Application Development Standardization Distributed Directory Systems Summary, Exercises Block-chain Databases Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Databases Deict-Based Databases Object-Based Databases Affile Consensus Distributed Directory Systems Distributed Directory Systems Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Database Design Object-Based Databases XML	'
Coordinator Selection Consensus in Distributed Systems Summary, Exercises Advanced Topics Advanced Indexing Techniques Bloom Filter Log-Structured Merge Tree and Variants Bitmap Indices Indexing of Spatial Data Hash Indices Summary, Exercises Advanced Application Development Performance Tuning Performance Benchmarks Other Issues in Application Development Standardization Distributed Directory Systems Summary, Exercises Block-chain Databases Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Databases Deict-Based Databases Object-Based Databases MML Information Retrieval	·
Consensus in Distributed Systems Summary, Exercises Advanced Topics Advanced Indexing Techniques Bloom Filter Log-Structured Merge Tree and Variants Bitmap Indices Indexing of Spatial Data Hash Indices Summary, Exercises Advanced Application Development Performance Tuning Performance Benchmarks Other Issues in Application Development Standardization Distributed Directory Systems Summary, Exercises Block-chain Databases Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Databases XML Information Retrieval	
Summary, Exercises Advanced Topics Advanced Indexing Techniques Bloom Filter Log-Structured Merge Tree and Variants Bitmap Indices Indexing of Spatial Data Hash Indices Summary, Exercises Advanced Application Development Performance Tuning Performance Benchmarks Other Issues in Application Development Standardization Distributed Directory Systems Summary, Exercises Block-chain Databases Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Query Languages Advanced Relational Databases XML Information Retrieval	
Advanced Indexing Techniques Bloom Filter Log-Structured Merge Tree and Variants Bitmap Indices Indexing of Spatial Data Hash Indices Summary, Exercises Advanced Application Development Performance Tuning Performance Benchmarks Other Issues in Application Development Standardization Distributed Directory Systems Summary, Exercises Block-chain Databases Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Database Design Object-Based Databases XML Information Retrieval	Consensus in Distributed Systems
Advanced Indexing Techniques Bloom Filter Log-Structured Merge Tree and Variants Bitmap Indices Indexing of Spatial Data Hash Indices Summary, Exercises Advanced Application Development Performance Tuning Performance Benchmarks Other Issues in Application Development Standardization Distributed Directory Systems Summary, Exercises Block-chain Databases Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Databases Design Object-Based Databases XML Information Retrieval	
Bloom Filter Log-Structured Merge Tree and Variants Bitmap Indices Indexing of Spatial Data Hash Indices Summary, Exercises Advanced Application Development Performance Tuning Performance Benchmarks Other Issues in Application Development Standardization Distributed Directory Systems Summary, Exercises Block-chain Databases Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Databases Design Object-Based Databases XML Information Retrieval	
Log-Structured Merge Tree and Variants Bitmap Indices Indexing of Spatial Data Hash Indices Summary, Exercises Advanced Application Development Performance Tuning Performance Bunchmarks Other Issues in Application Development Standardization Distributed Directory Systems Summary, Exercises Block-chain Databases Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Databases XML Information Retrieval	·
Bitmap Indices Indexing of Spatial Data Hash Indices Summary, Exercises Advanced Application Development Performance Tuning Performance Benchmarks Other Issues in Application Development Standardization Distributed Directory Systems Summary, Exercises Block-chain Databases Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Databases Design Object-Based Databases XML Information Retrieval	Bloom Filter
Indexing of Spatial Data Hash Indices Summary, Exercises Advanced Application Development Performance Tuning Performance Benchmarks Other Issues in Application Development Standardization Distributed Directory Systems Summary, Exercises Block-chain Databases Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Database Design Object-Based Databases XML Information Retrieval	
Hash Indices Summary, Exercises Advanced Application Development Performance Tuning Performance Benchmarks Other Issues in Application Development Standardization Distributed Directory Systems Summary, Exercises Block-chain Databases Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Database Design Object-Based Databases XML Information Retrieval	-
Summary, Exercises Advanced Application Development Performance Tuning Performance Benchmarks Other Issues in Application Development Standardization Distributed Directory Systems Summary, Exercises Block-chain Databases Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Database Design Object-Based Databases XML Information Retrieval	Indexing of Spatial Data
Advanced Application Development Performance Tuning Performance Benchmarks Other Issues in Application Development Standardization Distributed Directory Systems Summary, Exercises Block-chain Databases Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Database Design Object-Based Databases XML Information Retrieval	Hash Indices
Performance Tuning Performance Benchmarks Other Issues in Application Development Standardization Distributed Directory Systems Summary, Exercises Block-chain Databases Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Database Design Object-Based Databases XML Information Retrieval	Summary, Exercises
Performance Benchmarks Other Issues in Application Development Standardization Distributed Directory Systems Summary, Exercises Block-chain Databases Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Database Design Object-Based Databases XML Information Retrieval	
Other Issues in Application Development Standardization Distributed Directory Systems Summary, Exercises Block-chain Databases Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Database Design Object-Based Databases XML Information Retrieval	·
Standardization Distributed Directory Systems Summary, Exercises Block-chain Databases Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Database Design Object-Based Databases XML Information Retrieval	Performance Benchmarks
Distributed Directory Systems Summary, Exercises Block-chain Databases Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Database Design Object-Based Databases XML Information Retrieval	Other Issues in Application Development
Summary, Exercises Block-chain Databases Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Database Design Object-Based Databases XML Information Retrieval	Standardization
Block-chain Databases Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Database Design Object-Based Databases XML Information Retrieval	Distributed Directory Systems
Overview Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Database Design Object-Based Databases XML Information Retrieval	Summary, Exercises
Block-chain Properties Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Database Design Object-Based Databases XML Information Retrieval	Block-chain Databases
Achieving Blockchain Properties via Cryptographic Has Function Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Database Design Object-Based Databases XML Information Retrieval	
Consensus Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Database Design Object-Based Databases XML Information Retrieval	Block-chain Properties
Data Management in a Block-chain Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Database Design Object-Based Databases XML Information Retrieval	Achieving Blockchain Properties via Cryptographic Has Function
Smart Contracts Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Database Design Object-Based Databases XML Information Retrieval	Consensus
Performance Enhancement Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Database Design Object-Based Databases XML Information Retrieval	
Emerging Application Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Database Design Object-Based Databases XML Information Retrieval	
Summary, Exercises Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Database Design Object-Based Databases XML Information Retrieval	Performance Enhancement
Appendix: Detailed University Schema Online Chapters Formal Relational Query Languages Advanced Relational Database Design Object-Based Databases XML Information Retrieval	Emerging Application
Online Chapters Formal Relational Query Languages Advanced Relational Database Design Object-Based Databases XML Information Retrieval	
Formal Relational Query Languages Advanced Relational Database Design Object-Based Databases XML Information Retrieval	•
Advanced Relational Database Design Object-Based Databases XML Information Retrieval	-
Object-Based Databases XML Information Retrieval	
XML Information Retrieval	Advanced Relational Database Design
Information Retrieval	Object-Based Databases
	XML
PostgerSQL	Information Retrieval
	PostgerSQL

Software Engineering

Software Engineering: Reference-1

	Fundamentals of Software Engineerign
	Introduction
03	Evolution – From an Art Form to an Engineering Discipline – Topics 3
05	Software Development Projects – Topics 2
07	Exploratory Style of Software Development – Topics 2
15	Emergence of Software Engineering – Topics 8
16	Notable Changes in Software Development Practices
17	Computer Systems Engineering
	Summary and Exercises
	Software Life Cycle Models
18	A Few Basic Concepts
24	Waterfall Model and its Extensions – Topics 6
27	Rapid Application Development (RAD) – Topics 3
31	Agile Development Models – Topics 4
32	Spiral Model – Topics 1
33	A Comparison of Different Life Cycle Models – Topics 1
	Software Project Management
34	Software Project Management Complexities
36	Responsibilities of a Software Project Manager – Topics 2
28	Project Planning – Topics 2
30	Metrics for Project Size Estimation – Topics 2
33	Project Estimation Techniques – Topics 3
35	Empirical Estimation Techniques – Topics 2
38	COCOMO – A Heuristic Estimation Technique – Topics 4
43	Halstead's Software Science – An Analytical Technique – Topics 5
46	Staffing Level Estimation – Topics 3
51	Scheduling – Topics 5
53	Organization and Team Structures – Topics 2
54	Staffing
57	Risk Management – Topics 3
59	Software Configuration Management – Topics 2
60	Miscellaneous Plans
	Summary
	Requirements Analysis and Specification
62	Requirements Gathering and Analysis – Topics 2
73	Software Requirements Specification (SRS) – Topics 11
75	Formal System Specification – Topics 2
76	Axiomatic Specification
78	Algebraic Specification – Topics 2
79	Executable Specification and 4GL
, 3	Summary and Exercises
	Software Design
82	Overview of the Design Process – Topics 3
83	How to Characterize a Good Software Design? – Topics 1
85	Cohesion and Coupling – Topics 2
86	Layered Arrangement of Modules
88	Approaches to Software Design – Topics 2
00	Summary and Exercises
	Function-Oriented Software Design
89	
03	Overview of SA/SD Methodology

90	Structured Analysis Tonics 1
94	Structured Analysis – Topics 1
	Developing the DFD Model of a System – Topics 4
95	Structured Design – Topics 1
96	Detailed Design
97	Design Review
	Summary and Exercises
	Object Modelling Using UML
103	Basic Object-Orientation Concepts – Topics 6
105	Unified Modelling Language (UML) – Topics 2
106	UML Diagrams
112	Use Case Model – Topics 6
113	Class Diagrams
114	Interaction Diagrams
115	Activity Diagram
116	State Chart Diagram
118	Postscript – Topics 2
	Summary and Exercises
	Object-Oriented Software Development
121	Patterns – Topics 3
122	Some Common Design Patterns
130	An Object-Oriented Analysis and Design (OOAD) Methodology – Topics 8
131	Applications of the Analysis and Design Process
132	OOD Goodness Criteria
	Summary and Exercises
	User Interface Design
133	Characteristics of a Good User Interface
136	Basic Concepts – Topics 3
139	Types of User Interfaces – Topics 3
144	Fundamentals of Component-based GUI Development – Topics 5
146	A User Interface Design Methodology – Topics 2
	Summary and Exercises
	Coding and Testing
147	Coding – Topics 1
150	Code Review – Topics 3
152	Software Documentation – Topics 2
156	Testing – Topics 4
159	Black-box Testing – Topics 3
167	White-Box Testing – Topics 8
169	Debugging – Topics 2
171	Program Analysis Tools – Topics 2
172	Integration Testing – Topics 1
177	Testing Object-Oriented Programs – Topics 5
180	System Testing – Topics 3
181	Some General Issues Associated with Testing
	Summary and Exercises
	Software Reliability and Quality Management
184	Software Reliability – Topics 3
185	Statistical Testing – Topics 1
186	Software Quality
188	Software Quality Management System – Topics 2
196	ISO 9000 – Topics 8
199	SEI Capability Maturity Model – Topics 3
201	Few Other Important Quality Standards – Topics 2
202	Six Sigma
202	Summary and Exercises
	Summary and Exercises

	Computer Aided Software Engineering
203	Case and Its Scope
204	Case Environment – Topics 1
208	CASE Support in Software Life Cycle – Topics 4
215	Other Characteristics of Case Tools – Topics 7
216	Towards Second Generation CASE Tool
217	Architecture of a Case Environment
	Summary and Exercises
	Software Maintenance
219	Characteristics of Software Maintenance – Topics 2
220	Software Reverse Engineering
221	Software Maintenance Process Models
222	Estimation of Maintenance Cost
	Summary and Exercises
	Software Reuse
223	What Can be Reused?
224	Why Almost No Reuse So Far?
225	Basic Issues in any Reuse Program
230	A Reuse Approach – Topics 5
231	Reuse at Organization Level – Topics 1
	Summary and Exercises
	Emerging Trends
232	Client-Server Software
233	Client-Server Architectures
237	CORBA – Topics 4
239	COM/DCOM – Topics 2
240	Service-Oriented Architecture (SOA) – Topics 1
241	Software as a Service (SaaS)
	Summary and Exercises

Software Engineering: Reference-2

Software and Software Engineering 3 The Nature of Software Topics 3 4 The Unique nature of WebApps 5 Software Engineering 6 The Software Process 5 Software Engineering Practice – Topics 2 9 Software Engineering Practice – Topics 2 9 Software Mynths 10 How It All Starts Summary Problems and Points to Ponder Part-1: The Software Process Process Models 1 A Generic Process Models – Topics 3 14 Process Assessment and Improvement 19 Prescriptive Process Models – Topics 3 14 Process Assessment and Improvement 19 Prescriptive Process Models – Topics 3 24 The Unified Process – Topics 3 25 Specialized Process Models – Topics 2 27 Process Technology 28 Product and Process Summary Agile Development 29 What is Agility 30 Agility and the Cost of Change 31 What is an Agile Process Models – Topics 3 5 Extreme Programming (XP) – Topics 4 45 Other Agile Process Models – Topics 8 Summary Part-2: Modeling Principles That Guide Practice 47 Software Engineering Knowledge Core Principles – Topics 2 Principles That Guide Practice 55 Requirements Engineering Knowledge 64 Topics That Guide Practice 55 Requirements Engineering 55 Requirements Engineering 86 Liciting Requirements Summary Requirements Engineering 87 Requirements Engineering 88 Class-Based Modeling – Topics 4 50 Scenario-Based Modeling – Topics 4 51 Scenario-Based Modeling – Topics 4 52 Secnario-Based Modeling – Topics 4 53 Scenario-Based Modeling – Topics 4 54 Software Engineering Eng		
The Nature of Software — Topics 3 The Unique nature of WebApps Software Engineering The Software Process Software Engineering The Software Process Software Myths Software Myths How It All Starts Summary Problems and Points to Ponder Part-1: The Software Process Process Models A Generic Process Model — Topics 3 Process Assessment and Improvement Prescriptive Process Models — Topics 5 Specialized Process Models — Topics 3 The Unified Process Fopics 2 Personal and Team Process Models — Topics 3 Process Technology Product and Process Models — Topics 2 Process Technology Product and Process Models — Topics 2 Process Technology Republic Myther		Software Engineering: A Practitioner's Approach
The Unique nature of WebApps Software Engineering The Software Engineering Software Engineering Practice – Topics 2 Software Myhs How It All Starts Summary Problems and Points to Ponder Part-1: The Software Process Process Models A Generic Process Models – Topics 3 A Generic Process Models – Topics 3 The Unified Process – Topics 3 The Unified Process – Topics 2 Personal and Team Process Models – Topics 3 The Unified Process – Topics 2 Process Topics 3 Agile Development Agile Development Agile Development Agile Process Models – Topics 3 Streme Programming (XP) – Topics 4 Agilety and the Cost of Change What Is an Agilety Process Models – Topics 8 A Tool Set for the Agile Process Summary Part-2: Modeling Principles That Guide Practice Software Engineering Knowledge Core Principles – Topics 2 Principles That Guide Practice Software Engineering Knowledge Understanding Requirements Summary Understanding Requirements Sequirements Engineering Establishing the Groundwork – Topics 4 Developing use Cases Building the Requirements Model – Topics 3 Requirements Engineering Requirements Modeling – Topics 4 Core Principles That Guide Practice Software Engineering Knowledge Developing use Cases Building the Requirements Man San Agile Requirements Summary Requirements Engineering Requirements Engineering Requirements Analysis – Topics 4 Requirements Modeling – Topics 3 Class-Based Modeling – Topics 3 Class-Based Modeling – Topics 3 Data Modeling Concepts – Topics 3 Class-Based Modeling – Topics 6		· ·
Software Engineering		·
The Software Process		·
08 Software Engineering Practice — Topics 2 09 Software Myths 10 How It All Starts Summary Problems and Points to Ponder Part-1: The Software Process Process Models 13 A Generic Process Models — Topics 3 14 Process Assessment and Improvement 19 Prescriptive Process Models — Topics 5 22 Specialized Process Models — Topics 3 24 The Unified Process — Topics 2 25 Personal and Team Process Models — Topics 2 26 Personal and Team Process Models — Topics 2 27 Process Technology 28 Product and Process Summary Agile Development 29 What is Agility 30 Agility and the Cost of Change 31 What is an Agile Process — Topics 3 32 Extreme Programming (XP) — Topics 4 33 Other Agile Process Models — Topics 8 46 A Tool Set for the Agile Process Summary Part-2: Modeling Principles That Guide Practice 47 Software Engineering Knowledge 49 Core Principles — Topics 2 40 Principles That Guide Each Framework Activity — Topics 5 50 Summary Understanding Requirements 55 Requirements Engineering 59 Establishing the Groundwork — Topics 4 61 Eliciting Requirements 62 Developing Use Case 63 Eliciting Requirements 64 Negotiating Requirements 65 Negotiating Requirements 66 Building the Requirements 67 Negotiating Requirements 68 Validating Requirements 68 North Modeling — Topics 3 79 UML Models That Supplement the Use Case — Topics 2 69 Class-Based Modeling — Topics 3 60 Class-Based Modeling — Topics 6		
Software Myths		
How It All Starts Summary Problems and Points to Ponder		
Summary Problems and Points to Ponder Part.: The Software Process Process Models A Generic Process Model – Topics 3 Process Assessment and Improvement Prescriptive Process Models – Topics 5 Sepcialized Process Models – Topics 3 The Unified Process Models – Topics 3 The Unified Process — Topics 2 Product and Process Models – Topics 2 Product and Process Summary Agile Development What is Agility and the Cost of Change Agility and the Cost of Change What is Agility and the Cost of Change What is an Agile Process — Topics 3 Extreme Programming (XP) – Topics 4 Doher Agile Process Models – Topics 8 A Tool Set for the Agile Process Summary Part.2: Modeling Principles That Guide Practice Software Engineering Knowledge Principles That Guide Practice Principles That Guide Each Framework Activity – Topics 5 Summary Understanding Requirements Requirements Engineering Establishing the Groundwork – Topics 4 Developing Use Cases Building the Requirements Validating Requirements Validating Requirements Validating Requirements Validating Requirements Validating Requirements Summary Requirements Modeling – Topics 2 Requirements Modeling Escararios, Information, and Analysis Classes Requirements Modeling Cocapics 3 UML Models That Supplement the Use Case – Topics 2 Data Modeling Concepts – Topics 3 Class-Based Modeling – Topics 3		'
Problems and Points to Ponder Part-1: The Software Process Process Models 13	10	
Part-1: The Software Process Process Models A Generic Process Model – Topics 3 14 Process Assessment and Improvement 19 Prescriptive Process Models – Topics 5 22 Specialized Process Models – Topics 3 24 The Unified Process – Topics 2 26 Personal and Team Process Models – Topics 2 27 Process Technology 28 Product and Process Summary Agile Development 29 What is Agility 30 Agility and the Cost of Change 30 What Is an Agile Process – Topics 3 31 Extreme Programming (XP) – Topics 4 45 Other Agile Process Models – Topics 8 46 A Tool Set for the Agile Process Summary Part-2: Modeling Principes That Guide Practice 47 Software Engineering Knowledge 49 Core Principles – Topics 2 54 Principles That Guide Each Framework Activity – Topics 5 Summary Understanding Requirements 55 Requirements Engineering 59 Establishing the Groundwork – Topics 4 61 A Tool Set for the Agile Engineering 62 Establishing the Requirements 63 Eliciting Requirements – Topics 4 64 Developing Use Cases 66 Building the Requirements 68 Validating Requirements 68 Validating Requirements 68 Validating Requirements 68 Validating Requirements 69 Scenario-Based Modeling – Topics 3 70 UML Models That Supplement the Use Case – Topics 2 Data Modeling Concepts – Topics 3 60 Class-Based Modeling – Topics 6		
Process Models A Generic Process Model – Topics 3 Process Assessment and Improvement Prescriptive Process Models – Topics 5 Sepcialized Process Models – Topics 3 The Unified Process – Topics 2 Personal and Team Process Models – Topics 2 Process Technology Product and Process Summary Agile Development What is Agility Agility and the Cost of Change What is an Agile Process – Topics 3 Extreme Programming (XP) – Topics 4 Other Agile Process Models – Topics 8 A Tool Set for the Agile Process Summary Part-2: Modeling Principles That Guide Practice A Software Engineering Knowledge Ocor Principles – Topics 2 Principles That Guide Each Framework Activity – Topics 5 Summary Understanding Requirements Eliciting Requirements – Topics 4 Developing Use Cases Eliciting Requirements – Topics 2 Requirements Engineering Fopics 4 Developing Use Cases Eliciting Requirements Summary Requirements Modeling: Scenarios, Information, and Analysis Classes Requirements Modeling – Topics 2 Requirements Modeling – Topics 3 Mult Models That Supplement the Use Case – Topics 2 Requirements Modeling – Topics 3 Class-Based Modeling – Topics 6		
13 A Generic Process Model – Topics 3 14 Process Assessment and Improvement 19 Prescriptive Process Models – Topics 5 22 Specialized Process Models – Topics 3 24 The Unified Process – Topics 2 26 Personal and Team Process Models – Topics 2 27 Process Technology 28 Product and Process Summary Agile Development 29 What is Agility 30 Agility and the Cost of Change 31 What is an Agille Process – Topics 3 37 Extreme Programming (XP) – Topics 4 45 Other Agile Process Models – Topics 8 46 A Tool Set for the Agile Process Summary Part-2: Modeling Principles That Guide Practice 47 Software Engineering Knowledge 49 Core Principles – Topics 2 54 Principles That Guide Each Framework Activity – Topics 5 55 Summary Understanding Requirements 55 Requirements Engineering 59 Establishing the Groundwork – Topics 4 61 Eliciting Requirements – Topics 4 62 Developing Use Cases 63 Building the Requirements Model – Topics 2 64 Developing Use Cases 65 Usilding Requirements Model – Topics 2 66 Validating Requirements 67 Negotiating Requirements 68 Validating Requirements 68 Validating Requirements 69 Scenario-Based Modeling – Topics 3 60 Class-Based Modeling – Topics 3 61 Class-Based Modeling – Topics 3 62 Class-Based Modeling – Topics 6		
14 Process Assessment and Improvement 19 Prescriptive Process Models – Topics 5 22 Specialized Process Models – Topics 3 24 The Unified Process – Topics 2 26 Personal and Team Process Models – Topics 2 27 Process Technology 28 Product and Process Summary Agile Development 29 What is Agility 30 Agility and the Cost of Change 33 What Is an Agile Process – Topics 3 37 Extreme Programming (XP) – Topics 4 45 Other Agile Process Models – Topics 8 46 A Tool Set for the Agile Process Summary Part-2: Modeling Principles That Guide Practice 47 Software Engineering Knowledge 49 Core Principles – Topics 2 54 Principles That Guide Each Framework Activity – Topics 5 Summary Understanding Requirements 55 Requirements Engineering 59 Establishing the Groundwork – Topics 4 60 Developing Use Cases 61 Building the Requirements Model – Topics 2 62 Negotiating Requirements 63 Validating Requirements 64 Developing Use Cases 65 Usummary Counterstanding Requirements 66 Validating Requirements 67 Negotiating Requirements 68 Validating Requirements 69 Scenario-Based Modeling – Topics 3 60 Class-Based Modeling – Topics 3 61 Class-Based Modeling – Topics 6		
19 Prescriptive Process Models — Topics 5 22 Specialized Process Models — Topics 3 24 The Unified Process — Topics 2 26 Personal and Team Process Models — Topics 2 27 Process Technology 28 Product and Process Summary Agile Development 29 What is Agility 30 Agility and the Cost of Change 33 What is an Agile Process — Topics 3 36 Extreme Programming (XP) — Topics 4 45 Other Agile Process Models — Topics 8 46 A Tool Set for the Agile Process Summary Part-2: Modeling Principles That Guide Practice 47 Software Engineering Knowledge 49 Core Principles — Topics 2 54 Principles That Guide Each Framework Activity — Topics 5 Summary Understanding Requirements 55 Requirements Engineering 59 Establishing the Groundwork — Topics 4 61 Eliciting Requirements — Topics 4 62 Developing Use Cases 63 Building the Requirements Model — Topics 2 64 Negotiating Requirements 65 Nequirements — Requirements — Summary Requirements Analysis — Topics 2 70 Requirements Analysis — Topics 3 71 UML Models That Supplement the Use Case — Topics 2 72 Requirements Analysis — Topics 3 73 UML Models That Supplement the Use Case — Topics 2 74 Data Modeling Concepts — Topics 3 75 Liass—Based Modeling — Topics 6	13	·
22 Specialized Process Models – Topics 3 24 The Unified Process – Topics 2 26 Personal and Team Process Models – Topics 2 27 Process Technology 28 Product and Process Summary Agile Development 29 What is Agility 30 Agility and the Cost of Change 33 What is An Agile Process – Topics 3 37 Extreme Programming (XP) – Topics 4 45 Other Agile Process Models – Topics 8 46 A Tool Set for the Agile Process Summary Part-2: Modeling Principles That Guide Practice 47 Software Engineering Knowledge 49 Core Principles – Topics 2 54 Principles That Guide Each Framework Activity – Topics 5 Summary Understanding Requirements 55 Requirements Engineering 59 Establishing the Groundwork – Topics 4 64 Developing Use Cases 66 Building the Requirements Model – Topics 2 67 Negotiating Requirements 58 Validating Requirements 59 Negotiating Requirements 50 Negotiating Requirements 50 Negotiating Requirements 51 Negotiating Requirements 52 Neguirements Modeling: Scenarios, Information, and Analysis Classes 59 Requirements Modeling: Scenarios, Information, and Analysis Classes 70 Requirements Modeling – Topics 3 71 UML Models That Supplement the Use Case – Topics 2 61 Data Modeling Concepts – Topics 3 62 Class-Based Modeling – Topics 6		·
The Unified Process – Topics 2 Personal and Team Process Models – Topics 2 Process Technology Product and Process Summary Agile Development Mat is Agility Agility and the Cost of Change What is An Agile Process – Topics 3 Extreme Programming (XP) – Topics 4 Other Agile Process Models – Topics 8 A Tool Set for the Agile Process Summary Part-2: Modeling Principles That Guide Practice Software Engineering Knowledge Principles That Guide Practice For Principles That Guide Process Summary Understanding Requirements Requirements Engineering Establishing the Groundwork – Topics 4 Eliciting Requirements – Topics 4 Developing Use Cases Building Requirements Neguirements Requirements Validating Requirements Summary Requirements Model – Topics 2 Requirements Summary Requirements Analysis – Topics 4 Requirements Analysis – Topics 3 Class-Based Modeling – Topics 3 Class-Based Modeling – Topics 6 Class-Based Modeling – Topics 6	19	· ·
Personal and Team Process Models – Topics 2 Process Technology Product and Process Summary Agile Development Mhat is Agility Agility and the Cost of Change What is A agile Process – Topics 3 What is an Agile Process – Topics 4 Cother Agile Process Models – Topics 8 A Tool Set for the Agile Process Summary Part-2: Modeling Principles That Guide Practice Software Engineering Knowledge Core Principles – Topics 2 Principles That Guide Each Framework Activity – Topics 5 Summary Understanding Requirements Requirements Engineering Establishing the Groundwork – Topics 4 Eliciting Requirements – Topics 4 Eliciting Requirements – Topics 4 Eliciting Requirements Model – Topics 2 Requirements Requirements Summary Requirements Requirements Summary Requirements Requirements – Topics 4 Eliciting Requirements – Topics 4 Requirements Summary Requirements Modeling: Scenarios, Information, and Analysis Classes Requirements Analysis – Topics 3 Requirements Modeling - Topics 3 Class-Based Modeling – Topics 6 Class-Based Modeling – Topics 6		
27 Process Technology 28 Product and Process Summary Agile Development 29 What is Agility 30 Agility and the Cost of Change 33 What Is an Agile Process — Topics 3 37 Extreme Programming (XP) — Topics 4 45 Other Agile Process Models — Topics 8 46 A Tool Set for the Agile Process Summary Part-2: Modeling Principles That Guide Practice 47 Software Engineering Knowledge 49 Core Principles — Topics 2 54 Principles That Guide Each Framework Activity — Topics 5 Summary Understanding Requirements 55 Requirements Engineering 59 Establishing the Groundwork — Topics 4 63 Eliciting Requirements — Topics 4 64 Developing Use Cases 65 Building the Requirements Model — Topics 2 67 Negotiating Requirements 68 Validating Requirements 58 Validating Requirements 59 Requirements — Topics 4 61 Summary Requirements Modeling: Scenarios, Information, and Analysis Classes 70 Requirements Analysis — Topics 3 71 UML Models That Supplement the Use Case — Topics 2 72 Requirements Supplement the Use Case — Topics 2 73 Data Modeling — Topics 3 74 Class-Based Modeling — Topics 6		' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' '
28 Product and Process Summary Agile Development 29 What is Agility 30 Agility and the Cost of Change 33 What Is an Agile Process — Topics 3 37 Extreme Programming (XP) — Topics 4 45 Other Agile Process Models — Topics 8 46 A Tool Set for the Agile Process Summary Part-2: Modeling Principles That Guide Practice 47 Software Engineering Knowledge 49 Core Principles — Topics 2 54 Principles That Guide Each Framework Activity — Topics 5 Summary Understanding Requirements 55 Requirements Engineering 59 Establishing the Groundwork — Topics 4 61 Eliciting Requirements — Topics 4 62 Developing Use Cases 63 Building the Requirements 64 Validating Requirements 65 Negotiating Requirements 66 Validating Requirements 67 Negotiating Requirements 68 Validating Requirements 68 Validating Requirements 69 Scenario-Based Modeling - Topics 3 70 UML Models That Supplement the Use Case — Topics 2 80 Data Modeling Concepts — Topics 3 86 Class-Based Modeling — Topics 6		
Summary Agile Development 29 What is Agility 30 Agility and the Cost of Change 33 What is an Agile Process — Topics 3 37 Extreme Programming (XP) — Topics 4 45 Other Agile Process Models — Topics 8 46 A Tool Set for the Agile Process Summary Part-2: Modeling Principles That Guide Practice 47 Software Engineering Knowledge 49 Core Principles — Topics 2 54 Principles That Guide Each Framework Activity — Topics 5 Summary Understanding Requirements 55 Requirements Engineering 59 Establishing the Groundwork — Topics 4 63 Eliciting Requirements — Topics 4 64 Developing Use Cases 66 Building the Requirements 68 Validating Requirements 58 Summary Requirements Model — Topics 2 67 Negotiating Requirements 58 Summary Requirements Analysis — Topics 4 79 Scenario-Based Modeling — Topics 3 70 UML Models That Supplement the Use Case — Topics 2 80 Data Modeling — Topics 3 86 Class-Based Modeling — Topics 3	27	3,
Agile Development 29 What is Agility 30 Agility and the Cost of Change 33 What Is an Agile Process – Topics 3 37 Extreme Programming (XP) – Topics 4 45 Other Agile Process Models – Topics 8 46 A Tool Set for the Agile Process Summary Part-2: Modeling Principles That Guide Practice 47 Software Engineering Knowledge 49 Core Principles – Topics 2 54 Principles That Guide Each Framework Activity – Topics 5 Summary Understanding Requirements 55 Requirements Engineering 59 Establishing the Groundwork – Topics 4 63 Eliciting Requirements – Topics 4 64 Developing Use Cases 66 Building the Requirements Model – Topics 2 67 Negotiating Requirements Summary Requirements Modeling: Scenarios, Information, and Analysis Classes 72 Requirements Analysis – Topics 3 86 Class-Based Modeling – Topics 3 86 Class-Based Modeling – Topics 6	28	Product and Process
29 What is Agility 30 Agility and the Cost of Change 33 What Is an Agile Process – Topics 3 37 Extreme Programming (XP) – Topics 4 45 Other Agile Process Models – Topics 8 46 A Tool Set for the Agile Process Summary Part-2: Modeling Principles That Guide Practice 47 Software Engineering Knowledge 49 Core Principles – Topics 2 54 Principles That Guide Each Framework Activity – Topics 5 Summary Understanding Requirements 55 Requirements Engineering 59 Establishing the Groundwork – Topics 4 63 Eliciting Requirements — Topics 4 64 Developing Use Cases 66 Building the Requirements Model – Topics 2 67 Negotiating Requirements Summary Requirements Modeling: Scenarios, Information, and Analysis Classes 72 Requirements Analysis – Topics 3 73 UML Models That Supplement the Use Case – Topics 2 84 Class-Based Modeling – Topics 3 85 Class-Based Modeling – Topics 6		Summary
Agility and the Cost of Change What Is an Agile Process – Topics 3 Extreme Programming (XP) – Topics 4 5 Other Agile Process Models – Topics 8 46 A Tool Set for the Agile Process Summary Part-2: Modeling Principles That Guide Practice 47 Software Engineering Knowledge 49 Core Principles – Topics 2 54 Principles That Guide Each Framework Activity – Topics 5 Summary Understanding Requirements 55 Requirements Engineering 59 Establishing the Groundwork – Topics 4 63 Eliciting Requirements – Topics 4 64 Developing Use Cases 66 Building the Requirements Summary Requirements Modeling: Scenarios, Information, and Analysis Classes 72 Requirements Analysis – Topics 3 77 UML Models That Supplement the Use Case – Topics 2 80 Data Modeling Concepts – Topics 3 61 Class-Based Modeling – Topics 3		Agile Development
33 What Is an Agile Process — Topics 3 37 Extreme Programming (XP) — Topics 4 45 Other Agile Process Models — Topics 8 46 A Tool Set for the Agile Process Summary Part-2: Modeling Principles That Guide Practice 47 Software Engineering Knowledge 49 Core Principles — Topics 2 54 Principles That Guide Each Framework Activity — Topics 5 Summary Understanding Requirements 55 Requirements Engineering 59 Establishing the Groundwork — Topics 4 63 Eliciting Requirements — Topics 4 64 Developing Use Cases 66 Building the Requirements 68 Validating Requirements 68 Validating Requirements 59 Summary Requirements Modeling: Scenarios, Information, and Analysis Classes 70 Requirements Analysis — Topics 4 71 Scenario-Based Modeling — Topics 3 72 UML Models That Supplement the Use Case — Topics 2 73 Data Modeling Concepts — Topics 3 74 Class-Based Modeling — Topics 3	29	What is Agility
37 Extreme Programming (XP) – Topics 4 45 Other Agile Process Models – Topics 8 46 A Tool Set for the Agile Process Summary Part-2: Modeling Principles That Guide Practice 47 Software Engineering Knowledge 49 Core Principles – Topics 2 54 Principles That Guide Each Framework Activity – Topics 5 Summary Understanding Requirements 55 Requirements Engineering 59 Establishing the Groundwork – Topics 4 63 Eliciting Requirements – Topics 4 64 Developing Use Cases 66 Building the Requirements Model – Topics 2 67 Negotiating Requirements Summary Requirements Modeling: Scenarios, Information, and Analysis Classes 72 Requirements Analysis – Topics 3 73 UML Models That Supplement the Use Case – Topics 2 84 Class-Based Modeling – Topics 3 85 Class-Based Modeling – Topics 3	30	Agility and the Cost of Change
45 Other Agile Process Models – Topics 8 46 A Tool Set for the Agile Process Summary Part-2: Modeling Principles That Guide Practice 47 Software Engineering Knowledge 49 Core Principles – Topics 2 54 Principles That Guide Each Framework Activity – Topics 5 Summary Understanding Requirements 55 Requirements Engineering 59 Establishing the Groundwork – Topics 4 63 Eliciting Requirements – Topics 4 64 Developing Use Cases 66 Building the Requirements Model – Topics 2 67 Negotiating Requirements Summary Requirements Modeling: Scenarios, Information, and Analysis Classes 72 Requirements Analysis – Topics 3 75 Scenario-Based Modeling – Topics 3 86 Class-Based Modeling – Topics 3	33	What Is an Agile Process – Topics 3
46 A Tool Set for the Agile Process Summary Part-2: Modeling Principles That Guide Practice 47 Software Engineering Knowledge 49 Core Principles — Topics 2 54 Principles That Guide Each Framework Activity — Topics 5 Summary Understanding Requirements 55 Requirements Engineering 59 Establishing the Groundwork — Topics 4 63 Eliciting Requirements — Topics 4 64 Developing Use Cases 66 Building the Requirements Model — Topics 2 67 Negotiating Requirements 68 Validating Requirements 59 Summary Requirements Modeling: Scenarios, Information, and Analysis Classes 70 Requirements Analysis — Topics 4 71 Scenario-Based Modeling — Topics 3 72 UML Models That Supplement the Use Case — Topics 2 83 Data Modeling Concepts — Topics 3 84 Class-Based Modeling — Topics 6	37	
Summary Part-2: Modeling Principles That Guide Practice 47 Software Engineering Knowledge 49 Core Principles – Topics 2 54 Principles That Guide Each Framework Activity – Topics 5 Summary Understanding Requirements 55 Requirements Engineering 59 Establishing the Groundwork – Topics 4 63 Eliciting Requirements – Topics 4 64 Developing Use Cases 66 Building the Requirements Model – Topics 2 67 Negotiating Requirements 58 Validating Requirements Summary Requirements Modeling: Scenarios, Information, and Analysis Classes 72 Requirements Analysis – Topics 4 75 Scenario-Based Modeling – Topics 3 77 UML Models That Supplement the Use Case – Topics 2 80 Data Modeling Concepts – Topics 3 86 Class-Based Modeling – Topics 6	45	· ·
Part-2: Modeling Principles That Guide Practice 47 Software Engineering Knowledge 49 Core Principles – Topics 2 54 Principles That Guide Each Framework Activity – Topics 5 Summary Understanding Requirements 55 Requirements Engineering 59 Establishing the Groundwork – Topics 4 63 Eliciting Requirements – Topics 4 64 Developing Use Cases 66 Building the Requirements Model – Topics 2 67 Negotiating Requirements 68 Validating Requirements 68 Validating Requirements 69 Summary Requirements Modeling: Scenarios, Information, and Analysis Classes 72 Requirements Analysis – Topics 4 75 Scenario-Based Modeling – Topics 3 77 UML Models That Supplement the Use Case – Topics 2 80 Data Modeling Concepts – Topics 3 86 Class-Based Modeling – Topics 6	46	A Tool Set for the Agile Process
Principles That Guide Practice 47 Software Engineering Knowledge 49 Core Principles – Topics 2 54 Principles That Guide Each Framework Activity – Topics 5 Summary Understanding Requirements 55 Requirements Engineering 59 Establishing the Groundwork – Topics 4 63 Eliciting Requirements – Topics 4 64 Developing Use Cases 66 Building the Requirements Model – Topics 2 67 Negotiating Requirements Summary Requirements Modeling: Scenarios, Information, and Analysis Classes 72 Requirements Analysis – Topics 4 75 Scenario-Based Modeling – Topics 3 77 UML Models That Supplement the Use Case – Topics 2 80 Data Modeling Concepts – Topics 3 86 Class-Based Modeling – Topics 6		Summary
47 Software Engineering Knowledge 49 Core Principles – Topics 2 54 Principles That Guide Each Framework Activity – Topics 5 Summary Understanding Requirements 55 Requirements Engineering 59 Establishing the Groundwork – Topics 4 63 Eliciting Requirements – Topics 4 64 Developing Use Cases 66 Building the Requirements Model – Topics 2 67 Negotiating Requirements 68 Validating Requirements 59 Summary 60 Requirements 61 Requirements 62 Requirements 63 Validating Requirements 64 Validating Requirements 65 Summary 66 Requirements Modeling: Scenarios, Information, and Analysis Classes 66 Requirements Analysis – Topics 4 67 Scenario-Based Modeling – Topics 3 68 Class-Based Modeling Concepts – Topics 3 69 Data Modeling Concepts – Topics 3 60 Class-Based Modeling – Topics 6		·
49 Core Principles – Topics 2 54 Principles That Guide Each Framework Activity – Topics 5 Summary Understanding Requirements 55 Requirements Engineering 59 Establishing the Groundwork – Topics 4 63 Eliciting Requirements – Topics 4 64 Developing Use Cases 66 Building the Requirements Model – Topics 2 67 Negotiating Requirements 68 Validating Requirements 59 Summary Requirements Modeling: Scenarios, Information, and Analysis Classes 70 Requirements Analysis – Topics 3 71 UML Models That Supplement the Use Case – Topics 2 80 Data Modeling Concepts – Topics 3 81 Class-Based Modeling – Topics 6		Principles That Guide Practice
Summary Understanding Requirements Requirements Engineering Establishing the Groundwork – Topics 4 Eliciting Requirements – Topics 4 Developing Use Cases Building the Requirements Model – Topics 2 Negotiating Requirements Validating Requirements Summary Requirements Modeling: Scenarios, Information, and Analysis Classes Requirements Analysis – Topics 4 Scenario-Based Modeling – Topics 3 UML Models That Supplement the Use Case – Topics 2 Data Modeling Concepts – Topics 3 Class-Based Modeling – Topics 3	47	Software Engineering Knowledge
Summary Understanding Requirements Requirements Engineering Establishing the Groundwork – Topics 4 Eliciting Requirements – Topics 4 Developing Use Cases Building the Requirements Model – Topics 2 Negotiating Requirements Validating Requirements Summary Requirements Modeling: Scenarios, Information, and Analysis Classes Requirements Analysis – Topics 4 Scenario-Based Modeling – Topics 3 UML Models That Supplement the Use Case – Topics 2 Data Modeling Concepts – Topics 3 Class-Based Modeling – Topics 6	49	Core Principles – Topics 2
Understanding Requirements Requirements Engineering Establishing the Groundwork – Topics 4 Eliciting Requirements – Topics 4 Developing Use Cases Building the Requirements Model – Topics 2 Negotiating Requirements Validating Requirements Summary Requirements Modeling: Scenarios, Information, and Analysis Classes Requirements Analysis – Topics 4 Scenario-Based Modeling – Topics 3 UML Models That Supplement the Use Case – Topics 2 Data Modeling Concepts – Topics 3 Class-Based Modeling – Topics 6	54	Principles That Guide Each Framework Activity – Topics 5
55 Requirements Engineering 59 Establishing the Groundwork – Topics 4 63 Eliciting Requirements – Topics 4 64 Developing Use Cases 66 Building the Requirements Model – Topics 2 67 Negotiating Requirements 68 Validating Requirements 5 Summary Requirements Modeling: Scenarios, Information, and Analysis Classes 72 Requirements Analysis – Topics 4 75 Scenario-Based Modeling – Topics 3 77 UML Models That Supplement the Use Case – Topics 2 80 Data Modeling Concepts – Topics 6		Summary
Establishing the Groundwork – Topics 4 Eliciting Requirements – Topics 4 Developing Use Cases Building the Requirements Model – Topics 2 Negotiating Requirements Validating Requirements Summary Requirements Modeling: Scenarios, Information, and Analysis Classes Requirements Analysis – Topics 4 Scenario-Based Modeling – Topics 3 UML Models That Supplement the Use Case – Topics 2 Data Modeling Concepts – Topics 3 Class-Based Modeling – Topics 6		Understanding Requirements
63 Eliciting Requirements – Topics 4 64 Developing Use Cases 66 Building the Requirements Model – Topics 2 67 Negotiating Requirements 68 Validating Requirements Summary Requirements Modeling: Scenarios, Information, and Analysis Classes 72 Requirements Analysis – Topics 4 75 Scenario-Based Modeling – Topics 3 77 UML Models That Supplement the Use Case – Topics 2 80 Data Modeling Concepts – Topics 3 86 Class-Based Modeling – Topics 6	55	Requirements Engineering
64 Developing Use Cases 66 Building the Requirements Model – Topics 2 67 Negotiating Requirements 68 Validating Requirements Summary Requirements Modeling: Scenarios, Information, and Analysis Classes 72 Requirements Analysis – Topics 4 75 Scenario-Based Modeling – Topics 3 77 UML Models That Supplement the Use Case – Topics 2 80 Data Modeling Concepts – Topics 3 86 Class-Based Modeling – Topics 6	59	Establishing the Groundwork – Topics 4
66 Building the Requirements Model – Topics 2 67 Negotiating Requirements 68 Validating Requirements Summary Requirements Modeling: Scenarios, Information, and Analysis Classes 72 Requirements Analysis – Topics 4 75 Scenario-Based Modeling – Topics 3 77 UML Models That Supplement the Use Case – Topics 2 80 Data Modeling Concepts – Topics 3 86 Class-Based Modeling – Topics 6	63	Eliciting Requirements – Topics 4
67 Negotiating Requirements 68 Validating Requirements Summary Requirements Modeling: Scenarios, Information, and Analysis Classes 72 Requirements Analysis – Topics 4 75 Scenario-Based Modeling – Topics 3 77 UML Models That Supplement the Use Case – Topics 2 80 Data Modeling Concepts – Topics 3 86 Class-Based Modeling – Topics 6	64	Developing Use Cases
68 Validating Requirements Summary Requirements Modeling: Scenarios, Information, and Analysis Classes 72 Requirements Analysis – Topics 4 75 Scenario-Based Modeling – Topics 3 77 UML Models That Supplement the Use Case – Topics 2 80 Data Modeling Concepts – Topics 3 86 Class-Based Modeling – Topics 6	66	Building the Requirements Model – Topics 2
Summary Requirements Modeling: Scenarios, Information, and Analysis Classes Requirements Analysis – Topics 4 Scenario-Based Modeling – Topics 3 UML Models That Supplement the Use Case – Topics 2 Data Modeling Concepts – Topics 3 Class-Based Modeling – Topics 6	67	Negotiating Requirements
Requirements Modeling: Scenarios, Information, and Analysis Classes Requirements Analysis – Topics 4 Scenario-Based Modeling – Topics 3 UML Models That Supplement the Use Case – Topics 2 Data Modeling Concepts – Topics 3 Class-Based Modeling – Topics 6	68	Validating Requirements
72 Requirements Analysis – Topics 4 75 Scenario-Based Modeling – Topics 3 77 UML Models That Supplement the Use Case – Topics 2 80 Data Modeling Concepts – Topics 3 86 Class-Based Modeling – Topics 6		Summary
75 Scenario-Based Modeling – Topics 3 77 UML Models That Supplement the Use Case – Topics 2 80 Data Modeling Concepts – Topics 3 86 Class-Based Modeling – Topics 6		Requirements Modeling: Scenarios, Information, and Analysis Classes
77 UML Models That Supplement the Use Case – Topics 2 80 Data Modeling Concepts – Topics 3 86 Class-Based Modeling – Topics 6	72	Requirements Analysis – Topics 4
80 Data Modeling Concepts – Topics 3 86 Class-Based Modeling – Topics 6	75	Scenario-Based Modeling – Topics 3
86 Class-Based Modeling – Topics 6	77	UML Models That Supplement the Use Case – Topics 2
	80	Data Modeling Concepts – Topics 3
Summary	86	Class-Based Modeling – Topics 6
		Summary

	Paguiraments Madalings Flow Pohavior Patterns and Woh Anns
87	Requirements Modeling: Flow, Behavior, Patterns, and WebApps
	Requirements Modeling Strategies
91	Flow-Oriented Modeling – Topics 4
93	Creating a Behavioral Model – Topics 2
95	Patterns for Requirements Modeling – Topics 2
103	Requirements Modeling for WebApps – Topics 8
	Summary
	Design Concepts
104	Design within the Context of Software Engineering
106	The Design Process – Topics 2
118	Design Concepts – Topics 12
123	The Design Model – Topics 5
	Summary
	Architectural Design
127	Software Architecture – Topics 4
128	Architectural Genres
131	Architectural Styles – Topics 3
135	Architectural Design – Topics 4
138	Assessing Alternative Architectural Designs – Topics 3
140	Architectural Mapping Using Data Flow – Topics 2
	Summary
	Component-Level Design
143	What is a Component – Topics 3
147	Designing Class-Based Components – Topics 4
148	Conducting Component-Level Design
150	Component-Level Design for WebApps – Topics 2
153	Designing Traditional components – Topics 3
157	Component-Based Development – Topics 4
15/	
	Summary Heavisian Design
100	User Interface Design
160	The Golden Rules – Topics 3
162	User Interface Analysis and Design – Topics 2
166	Interface Analysis – Topics 4
169	Interface Design Steps – Topics 3
171	WebApp Interface Design – Topics 2
172	Design Evaluation
	Summary
	Pattern-Based Design
176	Design Patterns – Topics 4
181	Pattern-Based Software Design – Topics 5
182	Architectural Patterns
183	Component-Level Design Patterns
184	User Interface Design Patterns
186	WebApp Design Patterns – Topics 2
	Summary
	WebApp Design
187	WebApp Design Quality
188	Design Goals
189	A Design Pyramid for WebApps
190	WebApp Interface Design
192	Aesthetic Design – Topics 2
194	Content Design – Topics 2
196	Architecture Design – Topics 2
198	Navigation Design – Topics 2
199	Component-Level Design
	1

Summary Part-3: Quality Management Quality Concepts What is Quality Software Quality — Topics 5 The Software Quality — Topics 6 Achieving Software Quality — Topics 6 Softwareing Software Quality — Topics 4 Summary Review Techniques Cost Impact of Software Defects Defect Amplification and Removal Review: A formality Spectrum Informal Reviews — Topics 2 Review: A formality Spectrum Informal Reviews — Topics 4 Summary Software Quality Assurance Background Issues Software Quality Assurance Sog Background Issues Software Quality Assurance Sog Background Issues Formal Technical Reviews — Topics 2 Software Quality Assurance Sog Software Sog Software Quality Assurance Sog Software Sog Software Quality Assurance Sog Software Sog Software Quality Assurance Software Reliability — Topics 2 Software Reliability — Topics 3 Software Sog Software Software Testing — Topics 4 Strategic Issues Software Testing Strategies Software Testing Strategies Software Testing Strategies Software Testing Strategies For Software — Topics 2 Test Strategies for Conventional Software — Topics 2 Test Strategies for WebApps Software Testing — Topics 3 Software Testing — Topics 3 Software Testing — Topics 4 Software Testing — Topics 5 Software Testing — Topics 5 Software Testing — Topics 3 Software Testing — Topics 4 Software Testing — Topics 3 Software Testing — Topics 4 Software Testing — Topics 3 Software Testing — Topics 4 Softwa	202	Object-Oriented Hypermedia Design Method (OOHDM) – Topics 3
Quality Concepts		Summary
What is Quality Topics 5		Part-3: Quality Management
Software Quality — Topics 5		Quality Concepts
The Software Quality Dilemma – Topics 6 Achieving Software Quality – Topics 4 Summary Review Techniques 19 Cost Impact of Software Defects 20 Defect Amplification and Removal 212 Review Metrics and Their Use – Topics 2 223 Review: A formality Spectrum 224 Informal Reviews 225 Formal Technical Reviews – Topics 4 226 Software Quality Assurance 227 Background Issue 228 Bornal Technical Reviews – Topics 4 230 Elements of Software Quality Assurance 231 Software Quality Assurance 232 Software Quality Assurance 233 Formal Approaches to SQA 235 Software Reviews – Topics 2 236 Tormal Approaches to SQA 237 Software Reviews – Topics 2 238 The ISO 9000 Quality Standards 239 The SQA Plan Summary Software Testing Strategies 240 A strategic Approach to Software Testing – Topics 4 241 Strategic Issues 242 Test Strategies for Conventional Software – Topics 2 243 Test Strategies for Conventional Software – Topics 2 244 Strategic Issues 255 System Testing – Topics 3 257 System Testing – Topics 3 257 System Testing – Topics 4 268 Basis Path Testing – Topics 4 271 Control Structure Testing – Topics 4 272 Control Structure Testing – Topics 4 273 In the Art of Debugging – Topics 4 274 Software Testing Fundamentals 275 Black-Box Testing – Topics 5 276 Model-Based Testing 277 Esting Conventional Application 278 Black-Box Testing – Topics 4 279 Patterns for Software Testing 279 Patterns for Software Testing 270 Patterns for Software Testing 271 Control Structure Testing – Topics 4 272 Object-Oriented Testing Methods – Topics 2 278 Patterns for Software Testing 279 Deject-Oriented Testing Methods – Topics 5 280 Object-Oriented Testing Strategies – Topics 6	203	What is Quality
Achieving Software Quality – Topics 4 Summary Review Techniques 120 Defect Amplification and Removal 221 Review Metrics and Their Use – Topics 2 222 Review Set A formality Spectrum 122 Informal Reviews 122 Informal Reviews 122 Informal Reviews 123 Formal Technical Reviews – Topics 4 124 Informal Reviews 125 Software Quality Assurance 126 Background Issues 127 Software Quality Assurance 128 Sot Satistical Software Quality Assurance 129 Sot Satistical Software Quality Assurance 120 Elements of Software Quality Assurance 121 Software Reliability – Topics 2 122 Software Reliability – Topics 2 123 The ISO 9000 Quality Standards 124 Software Testing Strategies 125 Satistical Software Standards 126 Software Resides Office or Conventional Software – Topics 4 127 Software Resides Office or Object-Oriented Software – Topics 2 128 Test Strategies for Conventional Software – Topics 2 129 Test Strategies for Object-Oriented Software – Topics 2 120 Test Strategies for Debugging – Topics 3 120 Software Testing Fundamentals 120 Internal and External Views of Testing 121 Control Structure Testing – Topics 4 122 Software Testing Fundamentals 123 Internal and External Views of Testing 124 Control Structure Testing – Topics 4 125 Set Strategies For Software Testing 126 Model-Based Testing 127 Testing Conventional Application 128 Back Box Testing — Topics 4 129 Paterns for Software Testing 129 Testing Conventional Application 120 Software Testing Fundamentals 121 Control Structure Testing — Topics 3 122 Software Testing Fundamentals 123 Software Testing Fundamentals 124 Software Testing Fundamentals 125 Software Testing Fundamentals 126 Software Testing Fundamentals 127 Software Testing Fundamentals 128 Software Testing Fundamentals 129 Software	208	
Summary Review Techniques 219 Cost Impact of Software Defects 220 Defect Amplification and Removal 221 Review Metrics and Their Use – Topics 2 222 Reviews: A formality Spectrum 223 Reviews: A formality Spectrum 224 Informal Reviews 225 Formal Technical Reviews – Topics 4 226 Summary 227 Software Quality Assurance 228 Background Issues 230 Elements of Software Quality Assurance 231 Software Quality Assurance 232 SQA Tasks, Goals, and Metrics – Topics 2 233 Formal Approaches to SQA 235 Statistical Software Quality Assurance – Topics 2 236 Software Reliability – Topics 2 237 Software Reliability – Topics 2 238 The ISO 9000 Quality Standards 239 The SQA Plan 230 Summary 230 Software Testing Strategies 241 A Strategic Approach to Software Testing – Topics 4 242 Strategic Issues 243 Test Strategies for Conventional Software – Topics 2 244 Strategic Issues 252 Validation Testing – Topics 3 257 System Testing – Topics 3 258 System Testing – Topics 3 259 Software Testing – Topics 3 250 Software Testing Fundamentals 251 Internal and External Views of Testing 252 Mais Path Testing – Topics 4 253 Basis Path Testing – Topics 4 254 Mais Path Testing – Topics 4 255 Basis Path Testing – Topics 4 256 Mais Path Testing – Topics 4 257 Basis Path Testing – Topics 4 258 Basis Path Testing – Topics 4 259 Basis Path Testing – Topics 4 270 Model-Based Testing 271 Festing Conventional Application 272 Software Testing Fundamentals 273 Internal and External Views of Testing 274 Model-Based Testing 275 Basis Path Testing – Topics 4 276 Model-Based Testing 277 Testing Object-Oriented Applications 278 Testing Object-Oriented Applications 279 Paterns for Software Testing 280 Copiect-Oriented Testing Methods – Topics 5 291 Copiect-Oriented Testing Methods – Topics 6	214	·
Review Techniques 200 Defect Amplification and Removal 222 Review Metrics and Their Use – Topics 2 223 Reviews: A formality Spectrum 224 Informal Reviews 225 Formal Technical Reviews – Topics 4 226 Summary 227 Software Quality Assurance 228 Background Issues 229 Background Issues 230 Elements of Software Quality Assurance 230 Elements of Software Quality Assurance 231 Software Quality Assurance 232 SOA Tasks, Goals, and Metrics – Topics 2 233 Formal Approaches to SOA 233 Statistical Software Quality Assurance – Topics 2 234 Software Reliability – Topics 2 237 Software Reliability – Topics 2 238 The ISO 9000 Quality Standards 239 The SQA Plan Summary Software Testing Strategies 240 A Strategic Approach to Software Testing – Topics 4 241 Strategic Sprace for Conventional Software – Topics 2 242 Test Strategies for Object–Oriented Software – Topics 2 243 Test Strategies for Object–Oriented Software – Topics 2 244 Test Strategies for Debagging – Topics 4 252 Validation Testing – Topics 3 257 System Testing – Topics 5 251 The Art of Debugging – Topics 4 Summary 1esting Conventional Application 262 Software Testing Fundamentals Internal and External Views of Testing 263 Basis Path Testing – Topics 4 275 Black-Box Testing – Topics 4 276 Model-Based Testing 277 Setting For Specialized Environments, Architectures, and Applications – Topics 4 277 Black-Box Testing – Topics 4 278 Testing for Specialized Environments, Architectures, and Applications – Topics 4 279 Patterns for Software Testing 280 Patterns for Software Testing 291 Testing Object-Oriented Applications 292 All Testing Object-Oriented Testing Strategies – Topics 3 293 Object-Oriented Testing Strategies – Topics 3 294 Object-Oriented Testing Methods – Topics 6	218	Achieving Software Quality – Topics 4
Cost Impact of Software Defects		Summary
Defect Amplification and Removal		
Review Metrics and Their Use – Topics 2		·
Reviews: A formality Spectrum Informal Reviews Summary Software Quality Assurance 229 Background Issues 230 Elements of Software Quality Assurance 231 SQA Tasks, Goals, and Metrics – Topics 2 232 Formal Approaches to SQA 233 Formal Approaches to SQA 235 Statistical Software Quality Assurance – Topics 2 237 Software Reliability – Topics 2 238 The ISO 9000 Quality Standards 239 The SQA Plan Summary Software Testing Strategies 243 A Strategic Approach to Software Testing – Topics 4 Strategic Issues 244 Strategic Strategies for Conventional Software – Topics 2 245 Test Strategies for Object-Oriented Software – Topics 2 246 Test Strategies for WebApps 252 Validation Testing – Topics 3 257 System Testing – Topics 3 257 System Testing – Topics 5 261 The Art of Debugging – Topics 4 Summary Testing Conventional Application 262 Software Testing Fundamentals Internal and External Views of Testing 268 Basis Path Testing – Topics 4 Model-Based Testing Testing Object-Oriented Applications 276 Model-Based Testing Testing Object-Oriented Applications 287 Patternal Application Esting – Topics 3 288 Testing Topics 4 Testing Object-Oriented Applications 290 Patterns for Software Testing Testing Object-Oriented Applications 291 Broadening the View of Testing Testing Object-Oriented Applications 292 Patterns for Software Testing Testing Object-Oriented Applications 293 Testing Object-Oriented Applications 294 Testing Object-Oriented Applications 295 Dobject-Oriented Testing Methods – Topics 3 300 Object-Oriented Testing Methods – Topics 3		·
Informal Reviews Formal Technical Reviews - Topics 4		•
Software Quality Assurance 229 Background Issues 230 Elements of Software Quality Assurance 231 SQA Tasks, Goals, and Metrics – Topics 2 232 SGA Tasks, Goals, and Metrics – Topics 2 233 Formal Approaches to SQA 235 Statistical Software Quality Assurance — Topics 2 237 Software Reliability — Topics 2 238 The ISO 9000 Quality Standards 239 The SQA Plan Summary Software Testing Strategies 240 A Strategic Approach to Software Testing — Topics 4 241 Strategic Issues 242 Test Strategies for Conventional Software — Topics 2 243 Test Strategies for WebApps 244 Validation Testing — Topics 3 257 System Testing — Topics 3 257 System Testing — Topics 4 Summary Testing Conventional Application 262 Software Testing Fundamentals 263 Internal and External Views of Testing 404 White-Box Testing 405 Model-Based Testing 406 Model-Based Testing 407 Patterns for Software Testing 408 Patterns for Software Testing 409 Patterns for Software Testing 409 Patterns for Software Testing 400 Patterns for Software Testing 500 Patterns for Software Testing 501 Summary 502 Testing Topics 4 503 Bask-Box Testing — Topics 4 504 Model-Based Testing 505 Summary 506 Testing Fundaments, Architectures, and Applications — Topics 4 507 Summary 508 Testing for Specialized Environments, Architectures, and Applications — Topics 4 509 Patterns for Software Testing 509 Summary 500 Testing Object-Oriented Applications 501 Broadening the View of Testing 502 Software Testing Decided Testing 503 Testing Object-Oriented Testing Methods — Topics 3 504 Object-Oriented Testing Methods — Topics 3 505 Object-Oriented Testing Methods — Topics 6		. ,
Summary Software Quality Assurance 229 Background Issues 230 Elements of Software Quality Assurance 232 SQA Tasks, Goals, and Metrics – Topics 2 233 Formal Approaches to SQA 235 Statistical Software Quality Assurance — Topics 2 237 Software Reliability — Topics 2 238 The ISO 9000 Quality Standards 239 The SQA Plan Summary Software Testing Strategies 243 A Strategic Approach to Software Testing — Topics 4 244 Strategic Issues 245 Test Strategies for Conventional Software — Topics 2 246 Test Strategies for Object-Oriented Software — Topics 2 247 Test Strategies for Object-Oriented Software — Topics 2 248 Test Strategies for Object-Oriented Software — Topics 2 249 Test Strategies for Deliable Software — Topics 2 252 Validation Testing — Topics 3 257 System Testing — Topics 5 261 The Art of Debugging — Topics 4 262 Software Testing Fundamentals 263 Internal and External Views of Testing 264 White-Box Testing 265 Basis Path Testing — Topics 4 276 Model-Based Testing 277 Black-Box Testing — Topics 4 278 Testing For Specialized Environments, Architectures, and Applications — Topics 4 279 Patterns for Software Testing 280 Testing for Specialized Environments, Architectures, and Applications — Topics 4 281 Broadening the View of Testing 282 Testing for Specialized Environments, Architectures, and Applications — Topics 4 283 Testing Object-Oriented Applications 284 Testing Good and OOD Models — Topics 2 285 Testing Object-Oriented Testing Methods — Topics 3 286 Object-Oriented Testing Methods — Topics 3 287 Testing Object-Oriented Testing Methods — Topics 3		
Software Quality Assurance 229 Background Issues 230 Elements of Software Quality Assurance 231 SQA Tasks, Goals, and Metrics – Topics 2 232 SQA Tasks, Goals, and Metrics – Topics 2 233 Formal Approaches to SQA 235 Statistical Software Quality Assurance – Topics 2 237 Software Reliability – Topics 2 238 The ISO 9000 Quality Standards 239 The SQA Plan Summary Software Testing Strategies 243 A Strategic Approach to Software Testing – Topics 4 244 Strategic Issues 245 Test Strategies for Conventional Software – Topics 2 246 Test Strategies for Object-Oriented Software – Topics 2 247 Test Strategies for WebApps 252 Validation Testing – Topics 3 257 System Testing – Topics 3 257 System Testing – Topics 4 261 The Art of Debugging – Topics 4 262 Software Testing Fundamentals 263 Internal and External Views of Testing 264 White-Box Testing 265 Basis Path Testing – Topics 4 276 Model-Based Testing – Topics 3 277 Software Testing – Topics 4 278 Testing Conventional Application 279 Black-Box Testing – Topics 4 270 Model-Based Testing – Topics 4 271 Control Structure Testing – Topics 3 275 Black-Box Testing – Topics 4 276 Model-Based Testing – Topics 4 277 Condel-Based Testing – Topics 4 278 Testing for Specialized Environments, Architectures, and Applications – Topics 4 289 Testing for Specialized Environments, Architectures, and Applications – Topics 4 290 Patterns for Software Testing 291 Testing ODA and ODD Models – Topics 2 292 Object-Oriented Testing Strategies – Topics 3 293 Object-Oriented Testing Strategies – Topics 3 294 Object-Oriented Testing Strategies – Topics 3 295 Object-Oriented Testing Strategies – Topics 3 296 Object-Oriented Testing Strategies – Topics 6	228	
Background Issues		
Elements of Software Quality Assurance 323		
SQA Tasks, Goals, and Metrics – Topics 2 Formal Approaches to SQA Statistical Software Quality Assurance – Topics 2 Software Reliability – Topics 2 The ISO 9000 Quality Standards Summary Software Testing Strategies A Strategic Approach to Software Testing – Topics 4 Strategic Issues Test Strategies for Conventional Software – Topics 2 Test Strategies for Object-Oriented Software – Topics 2 Test Strategies for Object-Oriented Software – Topics 2 Test Strategies for WebApps Validation Testing – Topics 3 System Testing – Topics 5 The Art of Debugging – Topics 4 Summary Testing Conventional Application Software Testing Fundamentals Internal and External Views of Testing Hermal and External Views of Testing Basis Path Testing – Topics 4 Software Testing – Topics 4 Set Summary Testing Conventional Application Set Software Testing – Topics 4 Software Testing – Topics 4 Software Testing – Topics 4 Testing Conventional Application Set Testing – Topics 4 Testing Conventional Application Set Testing – Topics 4 Testing Fundamentals Testing Fundamentals The Art of Debugging – Topics 4 Testing Fundamentals Testing Conventional Application Set Testing – Topics 3 Testing Oos Posting – Topics 3 Testing Oos Posting – Topics 3 Testing Fundamentals – Topics 4 Testing Fundamentals – Topics 3 Testing Oos Posting – Topics 4 Testing Fundamentals – Topics 4 Testing Fundamentals – Topics 4 Testing Testing – Topics 4 Testing Object-Oriented Applications Testing Object-Oriented Applications Testing Object-Oriented Applications Testing Oos And OOD Models – Topics 2 Object-Oriented Testing Strategies – Topics 3 Object-Oriented Testing Strategies – Topics 3		•
Formal Approaches to SQA Statistical Software Quality Assurance – Topics 2 Software Reliability – Topics 2 The ISO 9000 Quality Standards The ISO 9000 Quality Standards The SQA Plan Summary Software Testing Strategies A Strategic Approach to Software Testing – Topics 4 Strategic Issues Test Strategies for Conventional Software – Topics 2 Test Strategies for Object-Oriented Software – Topics 2 Test Strategies for WebApps Test Strategies for WebApps Validation Testing – Topics 3 System Testing – Topics 5 The Art of Debugging – Topics 4 Summary Testing Conventional Application Software Testing Fundamentals Internal and External Views of Testing White-Box Testing – Topics 3 Back-Box Testing – Topics 4 Control Structure Testing – Topics 3 Testing for Specialized Environments, Architectures, and Applications – Topics 4 Patterns for Software Testing Summary Testing Object-Oriented Applications Patting OOA and OOD Models – Topics 2 Object-Oriented Testing Strategies – Topics 3 Object-Oriented Testing Strategies – Topics 3 Object-Oriented Testing Strategies – Topics 6		
Statistical Software Quality Assurance – Topics 2 37 Software Reliability – Topics 2 38 The ISO 9000 Quality Standards 39 The SQA Plan Summary Software Testing Strategies 243 A Strategic Approach to Software Testing – Topics 4 244 Strategic Issues 245 Test Strategies for Conventional Software – Topics 2 246 Test Strategies for Object-Oriented Software – Topics 2 247 Test Strategies for Object-Oriented Software – Topics 2 248 Test Strategies for WebApps 250 Validation Testing – Topics 3 251 System Testing – Topics 5 261 The Art of Debugging – Topics 4 Summary Testing Conventional Application 262 Software Testing Fundamentals 263 Internal and External Views of Testing 264 White-Box Testing 265 Basis Path Testing – Topics 4 276 Model-Based Testing 277 Selack-Box Testing – Topics 4 278 Model-Based Testing 289 Testing for Specialized Environments, Architectures, and Applications – Topics 4 290 Patterns for Software Testing Summary Testing Object-Oriented Applications 291 Broadening the View of Testing 393 Testing OOA and OOD Models – Topics 2 394 Object-Oriented Testing Strategies – Topics 3 305 Object-Oriented Testing Methods – Topics 6		
237 Software Reliability – Topics 2 238 The ISO 9000 Quality Standards 239 The SQA Plan Summary Software Testing Strategies 243 A Strategic Approach to Software Testing – Topics 4 244 Strategic Issues 246 Test Strategies for Conventional Software – Topics 2 247 Test Strategies for Object-Oriented Software – Topics 2 248 Test Strategies for WebApps 252 Validation Testing – Topics 3 257 System Testing – Topics 3 257 System Testing – Topics 4 Summary Testing Conventional Application 262 Software Testing Fundamentals 263 Internal and External Views of Testing 264 White-Box Testing – Topics 4 271 Control Structure Testing – Topics 4 272 Control Structure Testing – Topics 4 273 Testing for Specialized Environments, Architectures, and Applications – Topics 4 274 Testing Topics 4 275 Black-Box Testing – Topics 4 276 Model-Based Testing 277 Setting for Specialized Environments, Architectures, and Applications – Topics 4 278 Testing Object-Oriented Applications 279 Broadening the View of Testing 289 Testing ODA and OOD Models – Topics 2 290 Object-Oriented Testing Strategies – Topics 3 302 Object-Oriented Testing Methods – Topics 6		
The ISO 9000 Quality Standards The SQA Plan Summary Software Testing Strategies 243 A Strategic Approach to Software Testing – Topics 4 244 Strategic Issues 246 Test Strategies for Conventional Software – Topics 2 248 Test Strategies for Object-Oriented Software – Topics 2 249 Test Strategies for WebApps 252 Validation Testing – Topics 3 257 System Testing – Topics 5 261 The Art of Debugging – Topics 4 Summary Testing Conventional Application 262 Software Testing Fundamentals 263 Internal and External Views of Testing 264 White-Box Testing 268 Basis Path Testing – Topics 4 271 Control Structure Testing – Topics 3 275 Black-Box Testing – Topics 4 276 Model-Based Testing 289 Testing for Specialized Environments, Architectures, and Applications – Topics 4 290 Patterns for Software Testing Summary Testing Object-Oriented Applications 291 Broadening the View of Testing 292 Testing OOA and OOD Models – Topics 2 296 Object-Oriented Testing Strategies – Topics 3 302 Object-Oriented Testing Strategies – Topics 6		' '
The SQA Plan Summary Software Testing Strategies A Strategic Approach to Software Testing – Topics 4 244 Strategic Issues 245 Test Strategies for Conventional Software – Topics 2 246 Test Strategies for Object-Oriented Software – Topics 2 247 Test Strategies for WebApps 248 Test Strategies for WebApps 250 Validation Testing – Topics 3 251 System Testing – Topics 5 261 The Art of Debugging – Topics 4 Summary Testing Conventional Application 262 Software Testing Fundamentals 263 Internal and External Views of Testing 264 White-Box Testing 268 Basis Path Testing – Topics 4 271 Control Structure Testing – Topics 3 275 Black-Box Testing – Topics 4 276 Model-Based Testing 289 Testing for Specialized Environments, Architectures, and Applications – Topics 4 290 Patterns for Software Testing Summary Testing Object-Oriented Applications 291 Broadening the View of Testing 293 Testing OOA and OOD Models – Topics 2 296 Object-Oriented Testing Strategies – Topics 3 302 Object-Oriented Testing Strategies – Topics 6		
Summary Software Testing Strategies 243 A Strategic Approach to Software Testing – Topics 4 244 Strategic Issues 246 Test Strategies for Conventional Software – Topics 2 248 Test Strategies for Object-Oriented Software – Topics 2 249 Test Strategies for WebApps 252 Validation Testing – Topics 3 257 System Testing – Topics 5 261 The Art of Debugging – Topics 4 Summary Testing Conventional Application 262 Software Testing Fundamentals 263 Internal and External Views of Testing 264 White-Box Testing 268 Basis Path Testing – Topics 4 271 Control Structure Testing – Topics 4 276 Model-Based Testing 277 Black-Box Testing 289 Testing for Specialized Environments, Architectures, and Applications – Topics 4 290 Patterns for Software Testing 291 Broadening the View of Testing 293 Testing OOA and OOD Models – Topics 2 296 Object-Oriented Testing Strategies – Topics 3 302 Object-Oriented Testing Methods – Topics 6		'
Software Testing Strategies 243 A Strategic Approach to Software Testing – Topics 4 244 Strategic Issues 246 Test Strategies for Conventional Software – Topics 2 248 Test Strategies for Object-Oriented Software – Topics 2 249 Test Strategies for WebApps 252 Validation Testing – Topics 3 257 System Testing – Topics 5 261 The Art of Debugging – Topics 4 Summary Testing Conventional Application 262 Software Testing Fundamentals 263 Internal and External Views of Testing 264 White-Box Testing 268 Basis Path Testing – Topics 4 271 Control Structure Testing – Topics 3 275 Black-Box Testing – Topics 4 276 Model-Based Testing 289 Testing for Specialized Environments, Architectures, and Applications – Topics 4 290 Patterns for Software Testing Summary Testing Object-Oriented Applications 291 Broadening the View of Testing 293 Testing OOA and OOD Models – Topics 2 296 Object-Oriented Testing Strategies – Topics 3 302 Object-Oriented Testing Methods – Topics 6	239	
243 A Strategic Approach to Software Testing – Topics 4 244 Strategics Issues 246 Test Strategies for Conventional Software – Topics 2 248 Test Strategies for Object-Oriented Software – Topics 2 249 Test Strategies for WebApps 252 Validation Testing – Topics 3 257 System Testing – Topics 5 261 The Art of Debugging – Topics 4 Summary Testing Conventional Application 262 Software Testing Fundamentals 263 Internal and External Views of Testing 264 White-Box Testing 268 Basis Path Testing – Topics 4 271 Control Structure Testing – Topics 3 275 Black-Box Testing – Topics 4 276 Model-Based Testing 289 Testing for Specialized Environments, Architectures, and Applications – Topics 4 290 Patterns for Software Testing 291 Broadening the View of Testing 293 Testing OOA and OOD Models – Topics 2 296 Object-Oriented Testing Strategies – Topics 3 302 Object-Oriented Testing Methods – Topics 6		
244 Strategic Issues 246 Test Strategies for Conventional Software – Topics 2 248 Test Strategies for Object-Oriented Software – Topics 2 249 Test Strategies for WebApps 252 Validation Testing – Topics 3 257 System Testing – Topics 5 261 The Art of Debugging – Topics 4 Summary Testing Conventional Application 262 Software Testing Fundamentals 263 Internal and External Views of Testing 264 White-Box Testing 268 Basis Path Testing – Topics 4 271 Control Structure Testing – Topics 3 275 Black-Box Testing – Topics 4 276 Model-Based Testing 289 Testing for Specialized Environments, Architectures, and Applications – Topics 4 290 Patterns for Software Testing 291 Broadening the View of Testing 293 Testing OOA and OOD Models – Topics 2 296 Object-Oriented Testing Strategies – Topics 3 302 Object-Oriented Testing Methods – Topics 6	242	
Test Strategies for Conventional Software – Topics 2 Test Strategies for Object-Oriented Software – Topics 2 Test Strategies for WebApps 252 Validation Testing – Topics 3 257 System Testing – Topics 5 261 The Art of Debugging – Topics 4 Summary Testing Conventional Application 262 Software Testing Fundamentals 263 Internal and External Views of Testing 264 White-Box Testing 268 Basis Path Testing – Topics 4 271 Control Structure Testing – Topics 3 275 Black-Box Testing – Topics 4 276 Model-Based Testing 289 Testing for Specialized Environments, Architectures, and Applications – Topics 4 290 Patterns for Software Testing Summary Testing Object-Oriented Applications 291 Broadening the View of Testing 292 Testing OOA and OOD Models – Topics 2 293 Object-Oriented Testing Strategies – Topics 3 302 Object-Oriented Testing Methods – Topics 6		
Test Strategies for Object-Oriented Software – Topics 2 Test Strategies for WebApps 252 Validation Testing – Topics 3 257 System Testing – Topics 5 261 The Art of Debugging – Topics 4 Summary Testing Conventional Application 262 Software Testing Fundamentals 263 Internal and External Views of Testing 264 White-Box Testing 268 Basis Path Testing – Topics 4 271 Control Structure Testing – Topics 3 275 Black-Box Testing – Topics 4 276 Model-Based Testing 289 Testing for Specialized Environments, Architectures, and Applications – Topics 4 290 Patterns for Software Testing Summary Testing Object-Oriented Applications 291 Broadening the View of Testing 293 Testing OOA and OOD Models – Topics 2 296 Object-Oriented Testing Strategies – Topics 3 302 Object-Oriented Testing Methods – Topics 6		
Test Strategies for WebApps Validation Testing – Topics 3 System Testing – Topics 5 261 The Art of Debugging – Topics 4 Summary Testing Conventional Application 262 Software Testing Fundamentals 263 Internal and External Views of Testing 264 White-Box Testing 268 Basis Path Testing – Topics 4 271 Control Structure Testing – Topics 3 275 Black-Box Testing – Topics 4 276 Model-Based Testing 289 Testing for Specialized Environments, Architectures, and Applications – Topics 4 290 Patterns for Software Testing Summary Testing Object-Oriented Applications 291 Broadening the View of Testing 293 Testing OOA and OOD Models – Topics 2 296 Object-Oriented Testing Methods – Topics 6		
252 Validation Testing – Topics 3 257 System Testing – Topics 5 261 The Art of Debugging – Topics 4 Summary Testing Conventional Application 262 Software Testing Fundamentals 263 Internal and External Views of Testing 264 White-Box Testing 268 Basis Path Testing – Topics 4 271 Control Structure Testing – Topics 3 275 Black-Box Testing – Topics 4 276 Model-Based Testing 277 Testing for Specialized Environments, Architectures, and Applications – Topics 4 278 Testing for Specialized Environments, Architectures, and Applications – Topics 4 290 Patterns for Software Testing 290 Summary Testing Object-Oriented Applications 291 Broadening the View of Testing 293 Testing OOA and OOD Models – Topics 2 294 Object-Oriented Testing Strategies – Topics 3 305 Object-Oriented Testing Methods – Topics 6		
257 System Testing – Topics 5 261 The Art of Debugging – Topics 4 Summary Testing Conventional Application 262 Software Testing Fundamentals 263 Internal and External Views of Testing 264 White-Box Testing 268 Basis Path Testing – Topics 4 271 Control Structure Testing – Topics 3 275 Black-Box Testing – Topics 4 276 Model-Based Testing 289 Testing for Specialized Environments, Architectures, and Applications – Topics 4 290 Patterns for Software Testing Summary Testing Object-Oriented Applications 291 Broadening the View of Testing 293 Testing OOA and OOD Models – Topics 2 296 Object-Oriented Testing Strategies – Topics 3 302 Object-Oriented Testing Methods – Topics 6		
The Art of Debugging – Topics 4 Summary Testing Conventional Application 262 Software Testing Fundamentals 263 Internal and External Views of Testing 264 White-Box Testing 268 Basis Path Testing – Topics 4 271 Control Structure Testing – Topics 3 275 Black-Box Testing – Topics 4 276 Model-Based Testing 289 Testing for Specialized Environments, Architectures, and Applications – Topics 4 290 Patterns for Software Testing Summary Testing Object-Oriented Applications 291 Broadening the View of Testing 293 Testing OOA and OOD Models – Topics 2 296 Object-Oriented Testing Strategies – Topics 6 302 Object-Oriented Testing Methods – Topics 6		
Summary Testing Conventional Application 262 Software Testing Fundamentals 263 Internal and External Views of Testing 264 White-Box Testing 268 Basis Path Testing – Topics 4 271 Control Structure Testing – Topics 3 275 Black-Box Testing – Topics 4 276 Model-Based Testing 289 Testing for Specialized Environments, Architectures, and Applications – Topics 4 290 Patterns for Software Testing Summary Testing Object-Oriented Applications 291 Broadening the View of Testing 293 Testing OOA and OOD Models – Topics 2 296 Object-Oriented Testing Methods – Topics 6		
Testing Conventional Application 262 Software Testing Fundamentals 263 Internal and External Views of Testing 264 White-Box Testing 268 Basis Path Testing – Topics 4 271 Control Structure Testing – Topics 3 275 Black-Box Testing – Topics 4 276 Model-Based Testing 289 Testing for Specialized Environments, Architectures, and Applications – Topics 4 290 Patterns for Software Testing Summary Testing Object-Oriented Applications 291 Broadening the View of Testing 293 Testing OOA and OOD Models – Topics 2 296 Object-Oriented Testing Strategies – Topics 6 302 Object-Oriented Testing Methods – Topics 6	201	
262 Software Testing Fundamentals 263 Internal and External Views of Testing 264 White-Box Testing 268 Basis Path Testing – Topics 4 271 Control Structure Testing – Topics 3 275 Black-Box Testing – Topics 4 276 Model-Based Testing 289 Testing for Specialized Environments, Architectures, and Applications – Topics 4 290 Patterns for Software Testing Summary Testing Object-Oriented Applications 291 Broadening the View of Testing 293 Testing OOA and OOD Models – Topics 2 296 Object-Oriented Testing Strategies – Topics 6 302 Object-Oriented Testing Methods – Topics 6		
Internal and External Views of Testing White-Box Testing Basis Path Testing – Topics 4 Control Structure Testing – Topics 3 Black-Box Testing – Topics 4 Model-Based Testing Testing for Specialized Environments, Architectures, and Applications – Topics 4 Patterns for Software Testing Summary Testing Object-Oriented Applications Broadening the View of Testing Testing OOA and OOD Models – Topics 2 Object-Oriented Testing Strategies – Topics 6 Object-Oriented Testing Methods – Topics 6	262	
264 White-Box Testing 268 Basis Path Testing – Topics 4 271 Control Structure Testing – Topics 3 275 Black-Box Testing – Topics 4 276 Model-Based Testing 289 Testing for Specialized Environments, Architectures, and Applications – Topics 4 290 Patterns for Software Testing Summary Testing Object-Oriented Applications 291 Broadening the View of Testing 293 Testing OOA and OOD Models – Topics 2 296 Object-Oriented Testing Strategies – Topics 3 302 Object-Oriented Testing Methods – Topics 6		
268 Basis Path Testing – Topics 4 271 Control Structure Testing – Topics 3 275 Black-Box Testing – Topics 4 276 Model-Based Testing 289 Testing for Specialized Environments, Architectures, and Applications – Topics 4 290 Patterns for Software Testing Summary Testing Object-Oriented Applications 291 Broadening the View of Testing 293 Testing OOA and OOD Models – Topics 2 296 Object-Oriented Testing Strategies – Topics 3 302 Object-Oriented Testing Methods – Topics 6		
271 Control Structure Testing – Topics 3 275 Black-Box Testing – Topics 4 276 Model-Based Testing 289 Testing for Specialized Environments, Architectures, and Applications – Topics 4 290 Patterns for Software Testing Summary Testing Object-Oriented Applications 291 Broadening the View of Testing 293 Testing OOA and OOD Models – Topics 2 296 Object-Oriented Testing Strategies – Topics 3 302 Object-Oriented Testing Methods – Topics 6		
275 Black-Box Testing — Topics 4 276 Model-Based Testing 289 Testing for Specialized Environments, Architectures, and Applications — Topics 4 290 Patterns for Software Testing Summary Testing Object-Oriented Applications 291 Broadening the View of Testing 293 Testing OOA and OOD Models — Topics 2 296 Object-Oriented Testing Strategies — Topics 3 302 Object-Oriented Testing Methods — Topics 6		
276 Model-Based Testing 289 Testing for Specialized Environments, Architectures, and Applications – Topics 4 290 Patterns for Software Testing Summary Testing Object-Oriented Applications 291 Broadening the View of Testing 293 Testing OOA and OOD Models – Topics 2 296 Object-Oriented Testing Strategies – Topics 3 302 Object-Oriented Testing Methods – Topics 6		
Testing for Specialized Environments, Architectures, and Applications – Topics 4 Patterns for Software Testing Summary Testing Object-Oriented Applications 291 Broadening the View of Testing 293 Testing OOA and OOD Models – Topics 2 296 Object-Oriented Testing Strategies – Topics 3 302 Object-Oriented Testing Methods – Topics 6		
290 Patterns for Software Testing Summary Testing Object-Oriented Applications 291 Broadening the View of Testing 293 Testing OOA and OOD Models – Topics 2 296 Object-Oriented Testing Strategies – Topics 3 302 Object-Oriented Testing Methods – Topics 6		
Summary Testing Object-Oriented Applications 291 Broadening the View of Testing 293 Testing OOA and OOD Models – Topics 2 296 Object-Oriented Testing Strategies – Topics 3 302 Object-Oriented Testing Methods – Topics 6		
Testing Object-Oriented Applications 291 Broadening the View of Testing 293 Testing OOA and OOD Models – Topics 2 296 Object-Oriented Testing Strategies – Topics 3 302 Object-Oriented Testing Methods – Topics 6		
291 Broadening the View of Testing 293 Testing OOA and OOD Models – Topics 2 296 Object-Oriented Testing Strategies – Topics 3 302 Object-Oriented Testing Methods – Topics 6		
293 Testing OOA and OOD Models – Topics 2 296 Object-Oriented Testing Strategies – Topics 3 302 Object-Oriented Testing Methods – Topics 6	291	
296 Object-Oriented Testing Strategies – Topics 3 302 Object-Oriented Testing Methods – Topics 6		
	296	
204 Tariba Marila da Aprila de La Circula de La Circula de Circula	302	
304 Lesting Methods Applicable at the Class Level — Topics 2	304	Testing Methods Applicable at the Class Level – Topics 2
306 Interclass Test-Case Design – Topics 2	306	Interclass Test-Case Design – Topics 2

	Summary
	Testing Web Applications
310	Testing Web Applications Testing Concepts for WebApps – Topics 4
	The Testing Process – An Overview
311	
313	Content Testing – Topics 2
318	User Interface Testing – Topics 5
319	Component-Level Testing
321	Navigation Testing – Topics 2
323	Configuration Testing – Topics 2
324	Security Testing
327	Performance Testing – Topics 3
	Summary
	Formal Modeling and Verification
328	The Cleanroom Strategy
331	Functional Specification – Topics 3
333	Cleanroom Design – Topics 2
335	Cleanroom Testing – Topics 2
336	Formal Methods Concepts
337	Applying Mathematical Notation for Formal Specification
339	Formal Specification Languages – Topics 2
	Summary
	Software Configuration Management
343	Software Configuration Management – Topics 4
346	The SCM Repository – Topics 3
351	The SCM Process – Topics 5
357	Configuration management for WebApps – Topics 6
	Summary
	Product Metrics
362	A Framework for Product Metrics – Topics 5
364	Metrics for the Requirements Model – Topics 2
374	Metrics for the Design Model – Topics 8
375	Design Metrics for WebApps
376	Metrics for Source Code
378	Metrics for Testing – Topics 2
379	Metrics for Maintenance
	Summary
	Part-4: Managing Software Projects
	Project Management Concepts
383	The Management Spectrum – Topics 4
388	People – Topics 5
390	The Product – Topics 2
392	The Process – Topics 2
393	The Project
394	The W5HH Principle
395	Critical Practices
3.33	Summary
	Process and Project Metrics
397	Metrics in the Process and Project Domains – Topics 2
403	Software Measurement – Topics 6
405	Metrics for Software Quality – Topics 2
408	Integrating Metrics within the Software Process – Topics 3
409	Metrics for Small Organizations
410	Establishing a Software Metrics Program
110	Summary
	Estimation for Software Projects
	Estimation for software riojects

411	Observations on Estimation
412	The Project Planning Process
413	Software Scope and Feasibility
416	Resources – Topics 3
417	Software Project Estimation
426	Decomposition Techniques – Topics 9
429	Empirical Estimation Models – Topics 3
430	Estimation for Object-Oriented Projects
432	Specialized Estimation Techniques – Topics 2
434	The Make/Buy Decision – Topics 2
	Summary
	Project Scheduling
435	Basic Concepts
438	Project Scheduling – Topics 3
440	Defining a Task Set for the Software Project – Topics 2
441	Defining a Task Network
445	Scheduling – Topics 4
446	Earned Value Analysis
	Summary
	Risk Management
447	Reactive versus Proactive Risk Strategies
448	Software Risks
450	Risk Identification – Topics 2
452	Risk Projection – Topics 2
453	Risk Refinement
454	Risk Mitigation, Monitoring, and Management
455	The RMMM Plan
	Summary
	Maintenance and Reengineering
456	Software Maintenance
457	Software Supportability
458	Reengineering
460	Business Process Reengineering – Topics 2
462	Software Reengineering – Topics 2
465	Reverse Engineering – Topics 3
467	Restructuring – Topics 2
469	Forward Engineering – Topics 2
470	The Economics of Reengineering
	Summary
	Part-5: Advanced Topics
	Software Process Improvement
473	What is SPI – Topics 3
480	The SPI Process – Topics 7
481	The CMMI
482	The People CMM
483	Other SPI Frameworks
484	SPI Return on Investment
485	SPI Trends
	Summary
	Emerging Trends in Software Engineering
486	Technology Evolution
487	Observing Software Engineering Trends
494	Identifying 'Soft Trends' – Topics 7
501	Technology Directions – Topics 7
503	Tools-Related Trends – Topics 2

	Summary
	Concluding Comments
503	The Importance of Software – Revisited
504	People and The Way They Build Systems
505	New Modes for Representing Information
506	The Long View
507	The Software Engineer's Responsibility
508	A Final Comment
	Part-6: Appendix
509	An Introduction to UML
510	Object Oriented Concepts

Pure Mathematics – 1, 2, and 3

	Pure Mathematics (A-Level)
	P1: Algebra
01	Background Algebra
02	Linear Equations
03	Changing the Subject of a Formula
04	Quadratic Equations
05	Solving Quadratic Equations
06	Equations that cannot be Factorized
07	The Graphs of Quadratic Function
08	The Quadratic Formula
09	Inequalities
05	P2: Algebra
10	Operations with Polynomials
11	Solution of Polynomial Equations
12	The Modulus Function
12	P3: Further Algebra
13	The General Binomial Expansion
14	Review of Algebraic Functions
15	Partial Functions
16	Using Partial Functions with The Binomial Expansion
10	P1: Co-Ordinate Geometry
17	Co-Ordinates
18	Plotting, Sketching and Drawing
19	The Gradient of a Line
20	The Distance Between Two Points
21	The Mid-Point of a Line Joining Two Points
22	The Equation of a Straight Line
23	Finding the Equation of a Line
24	The Intersection of Two Line
25	Drawing Curves
26	The Intersection of A Line and A Curve
20	P1: Sequences and Series
27	Definitions and Notation
28	Arithmetic Progressions
29	Geometric Progressions
30	Binomial Expansions
	P1: Functions
31	The Language of Functions
32	Composite Functions
33	Inverse Functions
33	P1: Differentiation
34	The gradient of a Curve
35	Finding the Gradient of a Curve
36	Finding the Gradient from First Principles
37	Differentiating by Using Standard Results
38	Using Differentiation
39	Tangents and Normals
40	Maximum and Minimum Points
41	Increasing and Decreasing Functions
42	Points of Inflection
43	The Second Derivative
44	Applications
77	Аррисацопо

45	The Chain Rule
13	P2: Differentiation
46	The Product Rule
47	The Quotient Rule
48	Differentiating Natural Logarithms and Exponentials
49	Differentiating Trigonometrical Functions
50	Differentiating Functions Defined Implicitly
51	Parametric Equations
	Parametric Differentiation
52	
F2	P3: Differential Equations
53	Forming Differential Equations from Rates of Change
54	Solving Differential Equations
	P1: Integration
55	Reversing Differentiation
56	Finding the Area Under A Curve
57	Area as The Limit of A Sum
58	Areas Below the X Axis
59	The Area Between Tow Curves
60	The Area Between A Curve and the Y Axis
61	The Reverse Chain Rule
62	Improper Integrals
63	Finding Volumes by Integration
	P2: Integration
64	Integrals Involving The Exponential Function
65	Integrals Involving The Natural Logarithm Function
66	Integrals Involving Trigonometrical Functions
67	Numerical Integration
	P3: Further Integration
68	Integration by Substitution
69	Integrals Involving Exponentials and Natural Logarithms
70	Integrals Involving Trigonometrical Function
71	The Use of Partial Fractions in Integration
72	Integration by Parts
73	General Integration
	P1: Trigonometry
74	Trigonometry Background
75	Trigonometrical Functions
76	Trigonometrical Functions for Angles of any Size
77	The sine and cosine Graphs
78	The tangent graph
79	Solving Equations using Graphs of Trigonometrical Functions
80	Circular Measure
81	The Length of An ARC of A Circle
82	The Area of A Sector of A Circle
83	
65	Other Trigonometrical Functions
0.4	P2: Trigonometry
84	Reciprocal Trigonometrical Functions
85	Compound-Angle Formulae
86	Double-Angle Formulae
87	The Forms rcos, rsin
88	The General Solutions of Trigonometrical Equations
	P1: Vectors
89	Vectors in Two Dimensions
90	Vectors in Three Dimensions
91	Vectors Calculations

92	The Angle Between Two Vectors
	P3: Vectors
93	The Vector Equation of a Line
94	The Intersection of Two Lines
95	The Angle Between Two Lines
96	The Perpendicular Distance from A Point to a Line
97	The Vector Equation of a Plane
98	The Intersection of A Line and A Plane
99	The Distance of A Point from A Plane
100	The Angle Between A Line and A Plane
101	The Intersection of Two Planes
	P2: Logarithms and Exponentials
102	Logarithms
103	Exponential Functions
104	Modelling Curves
105	The Natural Logarithm Functions
106	The Exponential Function
	P2: Numerical Solution of Equations
107	Interval Estimation – Change-of-Sign Methods
108	Fixed-Point Iteration
	P3: Complex Numbers
109	The Growth of the Number System
110	Working with Complex Numbers
111	Representing Complex Numbers Geometrically
112	Sets of Points in An Argand Diagram
113	The Modulus-Argument form of Complex Numbers
114	Sets of Points Using The Polar Form
115	Working with Complex Numbers in Polar Form
116	Complex Exponents
117	Complex Numbers and Equations