

DETAILED CONTENTS

PREFACE

WELCOME – AND THANK YOU!	xlvi
TARGET AUDIENCE	xlvi
APPROACH(ES)	xlvi
ORGANIZATION	xlvi
<i>PART I: THE JAVA STUDENT SURVIVAL GUIDE</i>	<i>xlvi</i>
CHAPTER 1 - AN APPROACH TO THE ART OF PROGRAMMING	<i>xlvi</i>
CHAPTER 2 - SMALL VICTORIES.....	<i>xlvi</i>
CHAPTER 3 - PROJECT WALKTHROUGH: A COMPLETE EXAMPLE	<i>xlvii</i>
CHAPTER 4 - COMPUTERS, PROGRAMS, AND ALGORITHMS	<i>xlvii</i>
<i>PART II: LANGUAGE FUNDAMENTALS</i>	<i>xlvii</i>
CHAPTER 5 - OVERVIEW OF THE JAVA API.....	<i>xlvii</i>
CHAPTER 6 - SIMPLE JAVA PROGRAMS: USING PRIMITIVE AND REFERENCE DATA TYPES.....	<i>xlvii</i>
CHAPTER 7 - CONTROLLING THE FLOW OF PROGRAM EXECUTION	<i>xlvii</i>
CHAPTER 8 - ARRAYS.....	<i>xlvii</i>
CHAPTER 9 - TOWARD PROBLEM ABSTRACTION: CREATING NEW DATA TYPES	<i>xlviii</i>
CHAPTER 10 - COMPOSITIONAL DESIGN	<i>xlviii</i>
CHAPTER 11 - EXTENDING CLASS BEHAVIOR THROUGH INHERITANCE	<i>xlviii</i>
<i>PART III: GRAPHICAL USER INTERFACE PROGRAMMING</i>	<i>xlviii</i>
CHAPTER 12 - JAVA SWING API OVERVIEW.....	<i>xlviii</i>
CHAPTER 13 - HANDLING GUI EVENTS.....	<i>xlviii</i>
CHAPTER 14 - AN ADVANCED GUI PROJECT	<i>xlviii</i>
<i>PART IV: INTERMEDIATE CONCEPTS</i>	<i>xl ix</i>
CHAPTER 15 - EXCEPTIONS.....	<i>xl ix</i>
CHAPTER 16 - THREADS.....	<i>xl ix</i>
CHAPTER 17 - COLLECTIONS.....	<i>xl ix</i>
CHAPTER 18 - FILE I/O.....	<i>xl ix</i>
<i>PART V: NETWORK PROGRAMMING</i>	<i>xl ix</i>
CHAPTER 19 - INTRODUCTION TO NETWORKING AND DISTRIBUTED APPLICATIONS	<i>l</i>
CHAPTER 20 - CLIENT-SERVER APPLICATIONS.....	<i>l</i>
CHAPTER 21 - APPLETS AND JDBC.....	<i>l</i>
<i>PART VI: OBJECT-ORIENTED PROGRAMMING</i>	<i>l</i>
CHAPTER 22 - INHERITANCE, COMPOSITION, INTERFACES, AND POLYMORPHISM.....	<i>l</i>
CHAPTER 23 - WELL-BEHAVED OBJECTS.....	<i>li</i>
CHAPTER 24 - THREE DESIGN PRINCIPLES.....	<i>li</i>
CHAPTER 25 - HELPFUL DESIGN PATTERNS	<i>li</i>
Pedagogy	li
<i>LEARNING OBJECTIVES</i>	<i>li</i>
<i>INTRODUCTION</i>	<i>li</i>
<i>CONTENT</i>	<i>li</i>
<i>Quick Reviews</i>	<i>li</i>
<i>SUMMARY</i>	<i>lii</i>
<i>Skill-Building Exercises</i>	<i>lii</i>
<i>SUGGESTED PROJECTS</i>	<i>lii</i>
<i>SELF-TEST QUESTIONS</i>	<i>lii</i>
<i>REFERENCES</i>	<i>lii</i>
<i>NOTES</i>	<i>lii</i>
Typographical FORMATS	lii
<i>This Is An Example Of A First-Level Subheading</i>	<i>lii</i>

<i>This Is An Example Of A Second-Level Subheading</i>	lii
SOURCE CODE FORMATTING	liii
CD-ROM	liii
SUPPORTSITE™ WEBSITE	liii
PROBLEM REPORTING	liii
ABOUT THE AUTHORS	liii
ACKNOWLEDGMENTS	liv

PART I: THE JAVA STUDENT SURVIVAL GUIDE

I AN APPROACH TO THE ART OF PROGRAMMING

INTRODUCTION	4
<i>The Difficulties You Will Encounter Learning Java</i>	4
REQUIRED SKILLS	4
THE PLANETS WILL COME INTO ALIGNMENT.....	4
How This Chapter Will Help You	5
PROJECT MANAGEMENT	5
THREE SOFTWARE DEVELOPMENT ROLES	5
ANALYST	5
ARCHITECT.....	5
PROGRAMMER	6
A PROJECT-APPROACH STRATEGY	6
YOU HAVE BEEN HANDED A PROJECT – NOW WHAT?.....	6
STRATEGY AREAS OF CONCERN.....	6
THINK ABSTRACTLY.....	8
THE STRATEGY IN A NUTSHELL	8
APPLICABILITY TO THE REAL WORLD	8
THE ART OF PROGRAMMING	8
DON'T START AT THE COMPUTER	9
INSPIRATION STRIKES AT THE WEIRDEST TIME	9
OWN YOUR OWN COMPUTER	9
YOU EITHER HAVE TIME AND NO MONEY, OR MONEY AND NO TIME	9
THE FAMILY COMPUTER IS NOT GOING TO CUT IT!	9
SET THE MOOD	10
LOCATION, LOCATION, LOCATION.....	10
CONCEPT OF THE FLOW	10
THE STAGES OF FLOW.....	10
BE EXTREME	11
THE PROGRAMMING CYCLE.....	11
THE PROGRAMMING CYCLE SUMMARIZED.....	12
A HELPFUL TRICK: STUBBING	12
FIX THE FIRST COMPILER ERROR FIRST	12
MANAGING PROJECT COMPLEXITY	12
CONCEPTUAL COMPLEXITY	12
MANAGING CONCEPTUAL COMPLEXITY.....	13
PHYSICAL COMPLEXITY	13
THE RELATIONSHIP BETWEEN PHYSICAL AND CONCEPTUAL COMPLEXITY.....	14
MANAGING PHYSICAL COMPLEXITY.....	14
MAXIMIZE COHESION – MINIMIZE COUPLING	14
JAVA SOURCE FILE STRUCTURE	14
SAMPLE CLASS IN ACTION	15
GENERAL RULES FOR CREATING JAVA SOURCE FILES	16

<i>Rule-of-Thumb: ONE CLASS PER FILE</i>	17
<i>Avoid ANONYMOUS, NESTED, AND INNER CLASSES</i>	17
<i>CREATE A SEPARATE MAIN APPLICATION FILE</i>	17
PACKAGES	17
COMMENTING	18
<i>SINGLE-LINE COMMENTS</i>	18
<i>MULTI-LINE COMMENTS</i>	18
<i>JAVADOC COMMENTS</i>	19
<i>GENERATING JAVADOC EXAMPLE OUTPUT</i>	19
IDENTIFIER NAMING - WRITING SELF-COMMENTING CODE	19
<i>BENEFITS OF SELF-COMMENTING CODE</i>	20
<i>CODING CONVENTION</i>	20
<i>CLASS NAMES</i>	21
<i>CONSTANT NAMES</i>	21
<i>VARIABLE NAMES</i>	21
<i>METHOD NAMES</i>	22
SUMMARY	22
SKILL-BUILDING EXERCISES	22
SUGGESTED PROJECTS	24
SELF-TEST QUESTIONS	24
REFERENCES	25
NOTES	25

2 SMALL VICTORIES: CREATING JAVA PROJECTS

INTRODUCTION	28
JAVA PROJECT CREATION PROCESS	28
<i>SOURCE FILE CREATION STAGE</i>	29
<i>SOURCE FILE COMPILATION STAGE</i>	29
<i>WHAT IF A SOURCE FILE CONTAINS ERRORS?</i>	29
<i>MAIN APPLICATION EXECUTION STAGE</i>	29
<i>AUTOMATING THE JAVA PROJECT CREATION PROCESS</i>	30
INTEGRATED DEVELOPMENT ENVIRONMENTS	30
<i>TEXTPAD™ - J2SDK COMBINATION</i>	30
<i>SUN'S NETBEANS™</i>	30
<i>BORLAND® JBuilder®</i>	30
<i>Eclipse®</i>	30
CREATING JAVA PROJECTS USING MICROSOFT® WINDOWS® 2000/XP	31
<i>SUN'S JAVA 2 STANDARD EDITION SOFTWARE DEVELOPMENT KIT (J2SDK)</i>	31
<i>STEP 1: DOWNLOAD AND INSTALL THE J2SDK</i>	31
<i>STEPS 2 & 3: SETTING MICROSOFT WINDOWS ENVIRONMENT VARIABLES</i>	31
<i>ANOTHER HELPFUL HINT: DISPLAY FILES SUFFIXES AND FULL PATH NAMES</i>	36
<i>STEPS 4 & 5: SELECT A TEXT EDITOR AND CREATE THE SOURCE FILES</i>	36
<i>STEP 6: COMPILING THE SOURCE FILES</i>	38
<i>STEP 7: EXECUTING THE MAIN APPLICATION CLASS</i>	38
<i>BORLAND'S JBuilder</i>	39
<i>STEPS TO CREATING JAVA PROJECTS IN JBuilder</i>	39
<i>QUICK REVIEW</i>	45
CREATING JAVA PROJECTS USING LINUX™	45
<i>A BRIEF NOTE ON THE MANY FLAVORS OF LINUX</i>	46
<i>OBTAINING AND INSTALLING SUN'S J2SDK FOR LINUX</i>	46
<i>SELECTING AN INSTALLATION LOCATION</i>	47
<i>SETTING THE PATH ENVIRONMENT VARIABLE (bash shell)</i>	48
<i>SETTING THE CLASSPATH ENVIRONMENT VARIABLE (bash)</i>	49
<i>CREATING, COMPILING, AND RUNNING JAVA PROGRAMS</i>	49
<i>CREATING JAVA SOURCE FILES</i>	49

<i>Compiling JAVA SOURCE Files</i>	50
<i>Running The Application</i>	50
<i>Quick Review</i>	51
CREATING JAVA PROJECTS USING MACINTOSH OS X DEVELOPER TOOLS	51
<i>CREATING A JAVA PROJECT WITH XCODE</i>	51
<i>Quick Review</i>	52
CREATING AND RUNNING EXECUTABLE JAR FILES	53
<i>STEPS TO CREATE AN EXECUTABLE JAR FILE</i>	53
<i>STEP 1: CREATE YOUR JAVA PROGRAM</i>	53
<i>STEP 2: CREATE MANIFEST FILE</i>	54
<i>STEP 3: USE THE jar COMMAND</i>	54
<i>EXECUTING THE jar FILE</i>	54
<i>Quick Review</i>	54
SUMMARY	55
SKILL-BUILDING EXERCISES	55
SUGGESTED PROJECTS	56
SELF-TEST QUESTIONS	56
REFERENCES	57
NOTES	57

3 PROJECT WALKTHROUGH: A COMPLETE EXAMPLE

INTRODUCTION	60
THE PROJECT-APPROACH STRATEGY SUMMARIZED	60
DEVELOPMENT CYCLE	61
PROJECT SPECIFICATION	62
<i>ANALYZING THE PROJECT SPECIFICATION</i>	63
<i>APPLICATION REQUIREMENTS STRATEGY AREA</i>	63
<i>PROBLEM DOMAIN STRATEGY AREA</i>	64
<i>LANGUAGE FEATURES STRATEGY AREA</i>	66
<i>DESIGN STRATEGY AREA</i>	68
DEVELOPMENT CYCLE FIRST ITERATION	69
<i>PLAN (FIRST ITERATION)</i>	69
<i>CODE (FIRST ITERATION)</i>	70
<i>TEST (FIRST ITERATION)</i>	70
<i>INTEGRATE/TEST (FIRST ITERATION)</i>	70
DEVELOPMENT CYCLE SECOND ITERATION	70
<i>PLAN (SECOND ITERATION)</i>	71
<i>CODE (SECOND ITERATION)</i>	71
<i>TEST (SECOND ITERATION)</i>	71
<i>INTEGRATE/TEST (SECOND ITERATION)</i>	72
DEVELOPMENT CYCLE THIRD ITERATION	72
<i>PLAN (THIRD ITERATION)</i>	72
<i>CODE (THIRD ITERATION)</i>	73
<i>TEST (THIRD ITERATION)</i>	75
<i>INTEGRATE/TEST (THIRD ITERATION)</i>	75
DEVELOPMENT CYCLE FOURTH ITERATION	75
<i>PLAN (FOURTH ITERATION)</i>	75
<i>IMPLEMENTING STATE TRANSITION DIAGRAMS</i>	76
<i>IMPLEMENTING THE printFloor() METHOD</i>	77
<i>CODE (FOURTH ITERATION)</i>	77
<i>TEST (FOURTH ITERATION)</i>	79
<i>INTEGRATE/TEST (FOURTH ITERATION)</i>	79
DEVELOPMENT CYCLE FIFTH ITERATION	79
<i>PLAN (FIFTH ITERATION)</i>	80
<i>CODE (FIFTH ITERATION)</i>	81

<i>TEST (Fifth ITERATION)</i>	82
<i>INTEGRATE/TEST (Fifth ITERATION)</i>	82
SOME FINAL CONSIDERATIONS	82
COMPLETE ROBOTRAT.JAVA SOURCE CODE LISTING	84
SUMMARY	88
SKILL-BUILDING EXERCISES	88
SUGGESTED PROJECTS	88
SELF-TEST QUESTIONS	88
REFERENCES	89
NOTES	89

4 COMPUTERS, PROGRAMS, AND ALGORITHMS

INTRODUCTION	92
WHAT IS A COMPUTER?	92
<i>COMPUTER VS. COMPUTER SYSTEM</i>	92
<i>COMPUTER SYSTEM</i>	92
<i>PROCESSOR</i>	94
<i>THREE ASPECTS OF PROCESSOR ARCHITECTURE</i>	95
<i>FEATURE SET</i>	95
<i>FEATURE SET IMPLEMENTATION</i>	95
<i>FEATURE SET ACCESSIBILITY</i>	95
MEMORY ORGANIZATION	95
<i>MEMORY BASICS</i>	96
<i>MEMORY HIERARCHY</i>	96
<i>Bits, BYTES, WORDS</i>	96
<i>ALIGNMENT AND ADDRESSABILITY</i>	97
WHAT IS A PROGRAM?	98
<i>TWO VIEWS OF A PROGRAM</i>	98
<i>THE HUMAN PERSPECTIVE</i>	98
<i>THE COMPUTER PERSPECTIVE</i>	98
THE PROCESSING CYCLE	98
<i>FETCH</i>	99
<i>DECODE</i>	99
<i>EXECUTE</i>	99
<i>STORE</i>	99
<i>Why A PROGRAM CRASHES</i>	99
ALGORITHMS	99
<i>Good vs. Bad Algorithms</i>	100
<i>DON'T REINVENT THE WHEEL!</i>	102
THE JAVA HOTSPOT™ VIRTUAL MACHINE	102
<i>OBTAINING THE JAVA HOTSPOT™ VIRTUAL MACHINE</i>	102
<i>CLIENT & SERVER VIRTUAL MACHINES</i>	102
<i>CLASSIC VM vs. JIT vs. HOTSPOT™</i>	103
<i>JAVA HOTSPOT™ VIRTUAL MACHINE ARCHITECTURE</i>	103
SERVICES PROVIDED BY THE JAVA HOTSPOT™ VIRTUAL MACHINE AND THE JRE	103
SUMMARY	104
SKILL-BUILDING EXERCISES	104
SUGGESTED PROJECTS	104
SELF-TEST QUESTIONS	105
REFERENCES	105
NOTES	105

PART II: LANGUAGE FUNDAMENTALS

5 OVERVIEW OF THE JAVA PLATFORM API

INTRODUCTION	110
JAVA PLATFORM API PACKAGES	110
<i>Obtaining Detailed Java Platform API Information</i>	<i>111</i>
NAVIGATING A CLASS INHERITANCE HIERARCHY	112
<i>Deprecated Methods</i>	<i>115</i>
JAVA PLATFORM PACKAGES USED IN THIS BOOK	116
SUMMARY	117
SKILL-BUILDING EXERCISES	117
SUGGESTED PROJECTS	118
SELF-TEST QUESTIONS	118
REFERENCES	118
NOTES	119

6 Simple Java Programs: Using Primitive And Reference Data Types

INTRODUCTION	122
TERMINOLOGY	122
DEFINITION OF A JAVA PROGRAM	123
<i>Application Objects</i>	<i>123</i>
<i>Talking About Applications</i>	<i>123</i>
<i>Applet Objects</i>	<i>123</i>
CREATING SIMPLE JAVA PROGRAMS (APPLICATIONS)	123
<i>Structure Of A Java Application</i>	<i>124</i>
<i>Compiling And Executing SimpleApplication</i>	<i>125</i>
<i>Quick Review</i>	<i>125</i>
<i>Building Bigger Applications</i>	<i>126</i>
IDENTIFIERS AND IDENTIFIER NAMING RULES	126
<i>Well-Named Identifiers Will Simplify Your Life</i>	<i>127</i>
JAVA RESERVED KEYWORDS	127
JAVA TYPE CATEGORIES	129
<i>Primitive Data Types</i>	<i>129</i>
<i>Reference Data Types</i>	<i>130</i>
<i>Array Types</i>	<i>130</i>
WORKING WITH PRIMITIVE TYPES	130
<i>Application Class Structure</i>	<i>130</i>
<i>Definition Of The Term "Variable"</i>	<i>131</i>
<i>Declaring And Using Variables In The main() Method</i>	<i>131</i>
<i>Definition Of The Term "Constant"</i>	<i>132</i>
<i>Declaring And Using Constants In The main() Method</i>	<i>132</i>
<i>Getting Simple Input Into Your Program</i>	<i>133</i>
<i>Using The main() Method's String Array To Accept Input At Program Startup</i>	<i>133</i>
WORKING WITH REFERENCE TYPES	134
<i>Definition Of A Reference Variable</i>	<i>135</i>
<i>Definition Of An Object</i>	<i>135</i>
<i>Creating Objects with the new Operator</i>	<i>135</i>
<i>Garbage Collection</i>	<i>136</i>
ACCESSING CLASS MEMBERS FROM THE main() METHOD	136
<i>The main() Method Is A Static Method</i>	<i>137</i>
<i>Definition Of The Term Class Variable/Constant</i>	<i>137</i>

<i>Definition Of The Term Instance Variable/Constant</i>	137
<i>An Example</i>	137
STATEMENTS And Expressions	138
OPERATORS	139
<i>How To Read The Operator Table</i>	139
<i>Use Parentheses To Explicitly Force Precedence</i>	141
<i>Java Operators In Detail</i>	141
<i>Arithmetic Operators +, -, *, /</i>	141
<i>String Concatenation Operator +</i>	142
<i>Modulus (Integer Remainder) Operator %</i>	143
<i>Greater-Than/Less-Than Operators >, >=, <, <=</i>	143
<i>Equality And Inequality Operators ==, !=</i>	144
<i>Conditional AND and OR Operators &&, </i>	144
<i>Boolean AND, OR, XOR, and NOT Operators &, , ^, !</i>	145
<i>Ternary Conditional Operator ?:</i>	145
<i>Left Shift and Right Shift Operators <<, >>, >>></i>	146
<i>instanceof Operator</i>	147
<i>Unary Prefix And Postfix Increment And Decrement Operators ++, -</i>	147
<i>Member Access Operator</i>	147
<i>Bitwise AND, OR, XOR, and Complement Operators &, , ^, ~</i>	148
<i>Combination Assignment Operators +=, -=, *=, /=, <<=, >>=, >>>=, &=, =, ^=</i>	148
JAVA Primitive Type Wrapper Classes	149
SUMMARY	150
Skill-Building Exercises	150
SUGGESTED PROJECTS	151
Self-Test Questions	152
REFERENCES	152
NOTES	153

7 CONTROLLING THE FLOW OF PROGRAM EXECUTION

INTRODUCTION	156
SELECTION STATEMENTS	156
<i>if STATEMENT</i>	156
<i>Executing Code Blocks in if STATEMENTS</i>	157
<i>Executing Consecutive if STATEMENTS</i>	157
<i>if/else STATEMENT</i>	158
<i>Chained if/else STATEMENTS</i>	159
<i>switch STATEMENT</i>	159
<i>Nested Switch STATEMENT</i>	161
<i>Quick Review</i>	162
ITERATION STATEMENTS	162
<i>while STATEMENT</i>	162
<i>Personality of the while STATEMENT</i>	163
<i>do/while STATEMENT</i>	164
<i>Personality of the do/while STATEMENT</i>	164
<i>FOR STATEMENT</i>	165
<i>How The for STATEMENT is Related to the While STATEMENT</i>	165
<i>Personality of the for STATEMENT</i>	165
<i>Nesting Iteration STATEMENTS</i>	166
<i>Mixing Selection & Iteration STATEMENTS: A Powerful Combination</i>	166
<i>Quick Review</i>	168
BREAK AND CONTINUE	168
<i>Unlabeled break</i>	168
<i>Labeled break</i>	169
<i>Unlabeled CONTINUE</i>	170

<i>Labeled CONTINUE</i>	170
<i>Quick Review</i>	171
SELECTION AND ITERATION STATEMENT SELECTION TABLE	171
SUMMARY	173
SKILL-BUILDING EXERCISES	173
SUGGESTED PROJECTS	175
SELF-TEST QUESTIONS	176
REFERENCES	177
NOTES	177

8 ARRAYS

INTRODUCTION	180
WHAT IS AN ARRAY?	180
<i>Specifying Array Types</i>	181
<i>Quick Review</i>	182
FUNCTIONALITY PROVIDED BY JAVA ARRAY TYPES	182
<i>Array-Type Inheritance Hierarchy</i>	182
<i>The java.lang.reflect.Array Class</i>	182
<i>Special Properties Of Java Arrays</i>	183
<i>Quick Review</i>	183
CREATING AND USING SINGLE-DIMENSIONAL ARRAYS	183
<i>Arrays Of Primitive Types</i>	183
<i>How Primitive Type Array Objects Are Arranged In Memory</i>	184
<i>Calling Object And Class Methods On Array References</i>	185
<i>Creating Single-Dimensional Arrays Using Array Literal Values</i>	186
<i>Differences Between Arrays Of Primitive Types And Arrays Of Reference Types</i>	187
<i>Single-dimensional Arrays In Action</i>	187
<i>Message Array</i>	188
<i>Calculating Averages</i>	191
<i>Histogram: Letter Frequency Counter</i>	192
<i>Quick Review</i>	193
CREATING AND USING MULTIDIMENSIONAL ARRAYS	194
<i>Multidimensional Array Declaration Syntax</i>	194
<i>Memory Representation Of A Two Dimensional Array</i>	196
<i>Creating Multidimensional Arrays Using Array Literals</i>	196
<i>Ragged Arrays</i>	197
<i>Multidimensional Arrays In Action</i>	198
<i>Weighted Grade Tool</i>	198
<i>Quick Review</i>	199
THE MAIN() METHOD'S STRING ARRAY	200
<i>Purpose And Use Of The main() Method's String Array</i>	200
MANIPULATING ARRAYS WITH THE java.util.ARRAYS CLASS	201
JAVA API CLASSES USED IN THIS CHAPTER	202
SUMMARY	203
SKILL-BUILDING EXERCISES	203
SUGGESTED PROJECTS	204
SELF-TEST QUESTIONS	206
REFERENCES	207
NOTES	207

9 TOWARD PROBLEM ABSTRACTION: CREATING NEW DATA TYPES

INTRODUCTION	210
ABSTRACTION: Amplify THE ESSENTIAL – ELIMINATE THE IRRELEVANT	210

<i>Abstraction Is The Art Of Programming</i>	210
<i>Where Problem Abstraction Fits Into The Development Cycle</i>	210
<i>Creating Your Own Data Types</i>	211
<i>Case-Study Project: Write A People Manager Program</i>	211
<i>Quick Review</i>	213
The UML Class Diagram	213
<i>Quick Review</i>	214
Overview Of The Java Class Construct	214
<i>Four Categories Of Class Members</i>	214
<i>Static Or Class-Wide Fields</i>	214
<i>Non-Static Or Instance Fields</i>	215
<i>Static Or Class-Wide Methods</i>	215
<i>Non-Static Or Instance Methods</i>	215
<i>Access Modifiers</i>	215
<i>public</i>	215
<i>private</i>	215
<i>protected</i>	216
<i>package</i>	216
<i>The Concepts Of Horizontal Access, Interface, And Encapsulation</i>	216
<i>Quick Review</i>	217
Methods	217
<i>Method Naming – Use Action Words That Indicate The Method’s Purpose</i>	217
<i>Maximize Method Cohesion</i>	217
<i>Structure Of A Method Definition</i>	217
<i>Method Modifiers (optional)</i>	218
<i>Return Type Or void (optional)</i>	219
<i>Method Name (Mandatory)</i>	219
<i>Parameter List (optional)</i>	219
<i>Method Body (optional for abstract or native methods)</i>	219
<i>Example Method Definitions</i>	219
<i>Method Signatures</i>	220
<i>Overloading Methods</i>	220
<i>Constructor Methods</i>	220
<i>Quick Review</i>	220
Building And Testing The Person Class	221
<i>Start By Creating The Source File And Class Definition Shell</i>	221
<i>Defining Person Instance Fields</i>	221
<i>Defining Person Instance Methods</i>	221
<i>The Constructor Method</i>	222
<i>Adding A Few Accessor Methods</i>	222
<i>Testing The Person Class</i>	223
<i>Use The PeopleManagerApplication Class As A Test Driver</i>	223
<i>Adding Features To The Person Class – Calculating Age</i>	224
<i>Adding Features To The Person Class – Convenience Methods</i>	225
<i>Adding Features To The Person Class – Finishing Touches</i>	226
<i>Quick Review</i>	227
Building And Testing The PeopleManager Class	228
<i>Defining The PeopleManager Class Shell</i>	228
<i>Defining PeopleManager Fields</i>	228
<i>Defining PeopleManager Constructor Methods</i>	228
<i>Defining Additional PeopleManager Methods</i>	229
<i>Testing The PeopleManager Class</i>	230
<i>Adding Features To The PeopleManager Class</i>	230
<i>Quick Review</i>	232
More About Methods	232
<i>How Arguments Are Passed To Methods</i>	232
<i>Local Variable Scoping</i>	233
<i>Anywhere An Object Of <type> Is Required, A Method That Returns <type> Can Be Used</i>	233

<i>Quick Review</i>	234
Special Topics	234
<i>Static Initializers</i>	234
<i>Data Encapsulation - The Naked Truth</i>	235
<i>Quick Review</i>	236
SUMMARY	236
Skill-Building Exercises	237
SUGGESTED PROJECTS	238
SELF-TEST QUESTIONS	239
REFERENCES	241
NOTES	241

10 Compositional Design

INTRODUCTION	244
MANAGING CONCEPTUAL AND PHYSICAL COMPLEXITY	244
<i>Compiling Multiple Source Files Simultaneously with javac</i>	244
<i>Quick Review</i>	245
DEPENDENCY VS. ASSOCIATION	245
AGGREGATION	245
<i>Simple vs. Composite Aggregation</i>	246
<i>The Relationship Between Aggregation and Object Lifetime</i>	246
<i>Quick Review</i>	246
EXPRESSING AGGREGATION IN A UML CLASS DIAGRAM	246
<i>Simple Aggregation</i>	246
<i>Composite Aggregation</i>	247
AGGREGATION EXAMPLE CODE	247
<i>Simple Aggregation Example</i>	248
<i>Composite Aggregation Example</i>	249
<i>Quick Review</i>	250
SEQUENCE DIAGRAMS	250
<i>Quick Review</i>	251
THE AIRCRAFT ENGINE SIMULATION: AN EXTENDED EXAMPLE	251
<i>The Purpose of the Engine Class</i>	252
<i>Engine Class Attributes and Methods</i>	252
<i>PartStatus - A TypeSafe Enumeration Pattern</i>	254
<i>Aircraft Engine Simulation Sequence Diagrams</i>	254
RUNNING THE AIRCRAFT ENGINE SIMULATION PROGRAM	256
<i>Quick Review</i>	256
COMPLETE AIRCRAFT ENGINE SIMULATION CODE LISTING	257
SUMMARY	260
Skill-Building Exercises	260
SUGGESTED PROJECTS	261
SELF-TEST QUESTIONS	262
REFERENCES	263
NOTES	263

11 Extending Class Behavior Through Inheritance

INTRODUCTION	266
THREE PURPOSES OF INHERITANCE	266
<i>Implementing The "is A" Relationship</i>	267
<i>The Relationship Between The Terms Type, Interface, and Class</i>	267
<i>Meaning Of The Term Interface</i>	267

<i>MEANING OF THE TERM CLASS</i>	267
<i>Quick Review</i>	268
EXPRESSING GENERALIZATION & SPECIALIZATION IN THE UML	268
A SIMPLE INHERITANCE EXAMPLE	269
<i>THE UML DIAGRAM</i>	269
<i>BASECLASS SOURCE CODE</i>	269
<i>DERIVEDCLASS SOURCE CODE</i>	270
<i>DRIVERAPPLICATION PROGRAM</i>	270
<i>Quick Review</i>	271
ANOTHER INHERITANCE EXAMPLE: PERSON - STUDENT	271
<i>THE PERSON - STUDENT UML CLASS DIAGRAM</i>	271
<i>PERSON - STUDENT SOURCE CODE</i>	272
<i>CASTING</i>	274
<i>USE CASTING SPARINGLY</i>	275
<i>Quick Review</i>	275
OVERRIDING BASE CLASS METHODS	275
<i>Quick Review</i>	276
ABSTRACT METHODS & ABSTRACT BASE CLASSES	276
<i>THE PRIMARY PURPOSE OF AN ABSTRACT BASE CLASS</i>	276
<i>EXPRESSING ABSTRACT BASE CLASSES IN UML</i>	277
<i>Quick Review</i>	279
INTERFACES	279
<i>THE PURPOSE OF INTERFACES</i>	279
<i>AUTHORIZED INTERFACE MEMBERS</i>	279
<i>THE DIFFERENCES BETWEEN AN INTERFACE AND AN ABSTRACT CLASS</i>	280
<i>EXPRESSING INTERFACES IN UML</i>	280
<i>EXPRESSING REALIZATION IN A UML CLASS DIAGRAM</i>	280
<i>AN INTERFACE EXAMPLE</i>	281
<i>Quick Review</i>	282
CONTROLLING HORIZONTAL & VERTICAL ACCESS	283
<i>Quick Review</i>	285
FINAL CLASSES & METHODS	285
<i>Quick Review</i>	285
POLYMORPHIC BEHAVIOR	285
<i>Quick Review</i>	285
INHERITANCE EXAMPLE: EMPLOYEE	286
INHERITANCE EXAMPLE: AIRCRAFT ENGINE SIMULATION	288
<i>AIRCRAFT ENGINE SIMULATION UML DIAGRAM</i>	288
<i>SIMULATION OPERATIONAL DESCRIPTION</i>	290
<i>TAKE A DEEP BREATH AND RELAX!</i>	290
<i>COMPILING THE AIRCRAFT ENGINE SIMULATION CODE</i>	290
COMPLETE AIRCRAFT ENGINE SIMULATION CODE LISTING	290
TERMS & DEFINITIONS	297
SUMMARY	297
SKILL-BUILDING EXERCISES	298
SUGGESTED PROJECTS	299
SELF-TEST QUESTIONS	300
REFERENCES	301
NOTES	302

PART III: GRAPHICAL USER INTERFACE PROGRAMMING

12 JAVA SWING API OVERVIEW

INTRODUCTION	306
AWT and SWING	306
<i>NAMING CONVENTIONS</i>	307
THE MATHEMATICS of GUIs	307
<i>COORDINATE SYSTEMS</i>	307
<i>COMPONENTS AND THEIR BOUNDS</i>	308
TOP-LEVEL CONTAINERS	308
<i>WINDOW AND JWINDOW</i>	309
<i>FRAME AND JFRAME</i>	309
<i>DIALOG AND JDialog</i>	309
<i>OUR FIRST GUI PROGRAM</i>	310
<i>EXPLANATION OF THE CODE</i>	311
<i>TOP-LEVEL CONTAINERS API</i>	312
<i>TOP-LEVEL CONTAINER CONSTRUCTORS</i>	312
<i>DIALOGUE WITH A SKEPTIC</i>	313
<i>TOP-LEVEL CONTAINER METHODS</i>	314
<i>QUICK REVIEW</i>	316
ORGANIZING COMPONENTS INTO CONTAINERS	316
<i>ABSOLUTE POSITIONING</i>	316
<i>LAYOUT MANAGERS</i>	318
<i>FlowLayout</i>	318
<i>GridLayout</i>	320
<i>BorderLayout</i>	321
<i>GridBagLayout</i>	323
<i>COMBINING LAYOUT MANAGERS USING JPanels</i>	327
<i>QUICK REVIEW</i>	328
THE COMPONENTS	329
<i>BRIEF DESCRIPTIONS</i>	329
<i>COMPONENT, CONTAINER, AND JComponent METHODS</i>	331
<i>Component Method Tables</i>	332
<i>Container Method Tables</i>	335
<i>JComponent Method Tables</i>	336
<i>QUICK REVIEW</i>	337
THE FINAL GUI	337
<i>HIGHLIGHTS OF THE FINAL GUI</i>	341
<i>LAYOUT OF THE FINAL GUI</i>	342
SUMMARY	344
SKILL-BUILDING EXERCISES	345
SUGGESTED PROJECTS	346
SELF-TEST QUESTIONS	346
REFERENCES	347
NOTES	347

13 HANDLING GUI EVENTS

INTRODUCTION	350
EVENT-HANDLING BASICS	350
<i>THE EVENT</i>	350
<i>THE EVENT LISTENER</i>	351
<i>REGISTERING AN EVENT LISTENER WITH A COMPONENT</i>	351

Using the API	352
Choosing the Right Event	352
Quick Review	354
CREATING EVENT LISTENERS	354
LISTENINGMainFrame0	354
LISTENINGMainFrame1	355
STEP 1: APPLICATION BEHAVIOR	355
STEP 2: THE SOURCE	355
STEP 3: THE EVENT	355
STEP 4: THE LISTENER	357
STEP 5: THE DESIGN APPROACH: EXTERNAL CLASS	358
STEP 6: REGISTRATION	358
LISTENINGMainFrame2	358
STEP 1: APPLICATION BEHAVIOR	359
STEP 2: THE SOURCE	359
STEP 3: THE EVENT	359
STEP 4: THE LISTENER	361
STEP 5: THE DESIGN APPROACH: EXTERNAL CLASS WITH FIELDS	362
STEP 6: REGISTRATION	363
LISTENINGMainFrame3	364
STEP 1: APPLICATION BEHAVIOR	364
STEP 2: THE SOURCE	364
STEP 3: THE EVENT	364
STEP 4: THE LISTENER	365
STEP 5: THE DESIGN APPROACH: INNER CLASS (FIELD-LEVEL)	366
STEP 6: REGISTRATION	367
LISTENINGMainFrame4	367
STEP 1: APPLICATION BEHAVIOR	367
STEP 2: THE SOURCE	367
STEP 3: THE EVENT	367
STEP 4: THE LISTENER	367
STEP 5: THE DESIGN APPROACH: INNER CLASS (LOCAL-VARIABLE-LEVEL)	368
STEP 6: REGISTRATION	368
LISTENINGMainFrame5	368
STEP 1: APPLICATION BEHAVIOR	369
STEP 2: THE SOURCE	369
STEP 3: THE EVENT	369
STEP 4: THE LISTENER	369
STEP 5: THE DESIGN APPROACH: EXISTING CLASS	369
STEP 6: REGISTRATION	371
LISTENINGMainFrame6	371
STEP 1: APPLICATION BEHAVIOR	371
STEP 2: THE SOURCE	371
STEP 3: THE EVENT	371
STEP 4: THE LISTENER	372
STEP 5: THE DESIGN APPROACH: ANONYMOUS CLASS	372
STEP 6: REGISTRATION	372
LISTENINGMainFrame7	373
STEP 1: APPLICATION BEHAVIOR	373
STEP 2: THE SOURCE	373
STEP 3: THE EVENT	373
STEP 4: THE LISTENER	373
STEP 5: THE DESIGN APPROACH: ANONYMOUS CLASS AND INSTANCE	374
STEP 6: REGISTRATION	374
ADAPTERS	374
SUMMARY	375
SKILL-BUILDING EXERCISES	376
SUGGESTED PROJECTS	376

SELF-TEST QUESTIONS	377
REFERENCES	377
NOTES	377

14 AN ADVANCED GUI PROJECT

INTRODUCTION	380
<i>THE PROJECT</i>	380
<i>THE APPROACH</i>	380
STEP 1 – LAYING THE GROUNDWORK	381
<i>THE GARMENT CLASS</i>	381
<i>THE DRESSINGBOARD CLASS</i>	382
<i>GRAPHICS AND THE AWT/SWING FRAMEWORK</i>	382
<i>GRAPHICS (THE “HOW” OF DRAWING)</i>	382
<i>THE AWT/SWING FRAMEWORK (THE “WHEN” OF DRAWING)</i>	384
<i>CALLING REPAINT</i>	385
<i>OBTAINING A GRAPHICS2D</i>	386
<i>THE DRESSINGBOARD CLASS (CONTINUED)</i>	386
<i>LOADING AN IMAGE OR RESOURCE</i>	387
<i>THE MAINFRAME CLASS</i>	388
<i>QUICK REVIEW</i>	389
STEP 2 – SWING’S SEPARABLE MODEL ARCHITECTURE	389
<i>USING A LISTMODEL</i>	389
<i>THE MAINFRAME CLASS</i>	390
<i>QUICK REVIEW</i>	392
STEP 3 – WRITING A CUSTOM RENDERER	392
<i>USING A RENDERER</i>	393
<i>THE CHECKBOXLISTCELL CLASS</i>	394
<i>THE MAINFRAME CLASS</i>	396
<i>QUICK REVIEW</i>	398
STEP 4 – THE ART OF ILLUSION	398
<i>THE CHECKBOXLISTCELL CLASS</i>	401
<i>THE MAINFRAME CLASS</i>	402
<i>QUICK REVIEW</i>	403
STEP 5 – DEFINING YOUR OWN EVENTS AND EVENTLISTENERS	403
<i>THE CHECKBOXLISTCELL CLASS</i>	403
<i>THE MAINFRAME CLASS</i>	406
<i>QUICK REVIEW</i>	408
INTERLUDE – WRITING A CUSTOM EDITOR	408
<i>THE DEMOTREEORTABLECELLHANDLER CLASS</i>	410
<i>THE DEMOFRAME CLASS</i>	412
<i>QUICK REVIEW</i>	413
STEP 6 – A GOOD COMPONENT GETS BETTER	413
<i>THE DRAGLIST CLASS – OVERVIEW</i>	414
<i>ALGORITHM</i>	414
<i>USE DEFAULTLISTMODEL (LINES 41 - 65)</i>	414
<i>REORDEREVENT AND REORDERLISTENER (LINES 184 - 203)</i>	414
<i>THE DRAGLIST CLASS – DRAGGING</i>	415
<i>DRAGINDEX, DRAGITEM AND DRAGRECT ATTRIBUTES</i>	415
<i>DRAGSTART, DRAGTHRESHOLD AND ALLOWDRAG ATTRIBUTES</i>	415
<i>DELTA Y AND INDRAG ATTRIBUTES</i>	415
<i>HOW THE INDRAG ATTRIBUTE IS USED</i>	416
<i>THE DRAGLIST CLASS – PAINTING</i>	416
<i>THE CREATEDRAGIMAGE() METHOD (LINES 66 - 94)</i>	416
<i>THE PAINTCOMPONENT() METHOD (LINES 95 - 108)</i>	417
<i>THE DRAGLIST CLASS – CODE</i>	417
<i>THE MAINFRAME CLASS</i>	419

SUMMARY	421
SKILL-BUILDING EXERCISES	422
SUGGESTED PROJECTS	422
SELF-TEST QUESTIONS	423
REFERENCES	423
NOTES	423

PART IV: INTERMEDIATE CONCEPTS

15 EXCEPTIONS

INTRODUCTION	428
THE THROWABLE CLASS HIERARCHY	428
<i>Errors</i>	429
<i>Exceptions</i>	429
<i>RuntimeExceptions</i>	429
<i>Checked vs. Unchecked Exceptions</i>	430
<i>Quick Review</i>	430
HANDLING EXCEPTIONS	430
<i>Try/Catch Statement</i>	431
<i>Multiple Catch Blocks</i>	431
<i>The Importance Of Exception Type And Order In Multiple Catch Blocks</i>	432
<i>Manipulating A Throwable Object</i>	433
<i>Try/Catch/Finally Statement</i>	435
<i>Try/Finally Statement</i>	435
<i>Quick Review</i>	436
THROWING EXCEPTIONS	436
<i>The Throws Clause</i>	436
<i>The Throw Keyword</i>	437
<i>Quick Review</i>	438
CREATING CUSTOM EXCEPTIONS	438
<i>High & Low Level Abstractions</i>	438
<i>Extending The Exception Class</i>	438
<i>Some Advice On Naming Your Custom Exceptions</i>	440
<i>Quick Review</i>	440
SUMMARY	440
SKILL-BUILDING EXERCISES	441
SUGGESTED PROJECTS	441
SELF-TEST QUESTIONS	441
REFERENCES	441
NOTES	442

16 THREADS

INTRODUCTION	444
WHAT IS A THREAD?	444
<i>Quick Review</i>	446
BUILDING A CLOCK COMPONENT	446
<i>currentThread(), sleep(), interrupt(), interrupted() and isInterrupted()</i>	447
<i>Creating Your Own Threads</i>	449
<i>Quick Review</i>	451

Computing Pi	452
<i>Quick Review</i>	<i>455</i>
Thread Priority and Scheduling	455
<i>Your Results May Vary</i>	<i>457</i>
<i>Quick Review</i>	<i>458</i>
Race Conditions	459
<i>The Mechanics of Synchronization</i>	<i>460</i>
<i>Three Basic Rules of Synchronization</i>	<i>462</i>
<i>Synchronization Rule 1.....</i>	<i>462</i>
<i>Synchronization Rule 2.....</i>	<i>463</i>
<i>Synchronization Rule 3.....</i>	<i>465</i>
<i>Synchronizing Methods</i>	<i>466</i>
<i>Quick Review</i>	<i>467</i>
The Producer-Consumer Relationship	468
<i>Quick Review</i>	<i>473</i>
Deadlock	474
<i>Quick Review</i>	<i>476</i>
About the Pi-Generating Algorithm	477
Summary	477
Skill-Building Exercises	478
Suggested Projects	479
Self-Test Questions	479
References	480
Notes	480

17 Collections

Introduction	482
Case Study: Building A Dynamic Array	482
<i>Evaluating DynamicArray</i>	<i>484</i>
<i>The ArrayList Class To The Rescue</i>	<i>484</i>
<i>The Power Of Collections – Polymorphic Code</i>	<i>485</i>
Java Collections Framework Overview	486
<i>The Purpose Of The Collections Framework</i>	<i>486</i>
<i>Framework Organization</i>	<i>486</i>
<i>Core Collections Interfaces.....</i>	<i>486</i>
<i>General Purpose Implementation Classes.....</i>	<i>487</i>
<i>Mapping An Implementation Class To Its Underlying Data Structure.....</i>	<i>492</i>
<i>Algorithms.....</i>	<i>492</i>
<i>Infrastructure.....</i>	<i>493</i>
<i>Quick Review</i>	<i>493</i>
Java 1.4.2 Style Collections	493
<i>Creating A Set From A List</i>	<i>494</i>
<i>PeopleManager Revisited</i>	<i>494</i>
<i>Casting Retrieved Objects</i>	<i>496</i>
<i>Creating New Data Structures From Existing Collections</i>	<i>497</i>
<i>Quick Review</i>	<i>499</i>
Java 5 Style Collections: Generics	499
<i>Java 5 Collection Framework Core Interfaces</i>	<i>499</i>
<i>Java 5 Collections Framework Sample Programs</i>	<i>500</i>
<i>SetTestApp Program Revised.....</i>	<i>500</i>
<i>When To Use The Enhanced For Loop.....</i>	<i>501</i>
<i>Static Polymorphism – Generic Methods</i>	<i>501</i>
<i>Quick Review</i>	<i>502</i>
<i>Moving Forward</i>	<i>502</i>
Summary	503

Skill-Building Exercises	503
Suggested Projects	504
Self-Test Questions	504
References	505
Notes	505

18 File I/O

Introduction	508
JAVA I/O PACKAGE OVERVIEW	508
<i>File</i> Class	508
<i>InputStream</i> Classes	508
<i>OutputStream</i> Classes	510
Reader Classes	510
Writer Classes	510
<i>RandomAccessFile</i> Class	510
How Do You Choose Between Byte Streams, Character Streams, and <i>RandomAccessFile</i> ?	510
Another Way To Categorize The Java I/O Classes	510
Quick Review	512
Using The File Class	513
Quick Review	515
SEQUENTIAL BYTE STREAM FILE I/O USING INPUT- & OUTPUTSTREAMS	515
<i>OutputStreams</i>	515
<i>FileOutputStream</i>	515
<i>BufferedOutputStream</i>	516
<i>DataOutputStream</i>	517
<i>ObjectOutputStream</i>	518
<i>PrintStream</i>	520
<i>InputStreams</i>	520
<i>FileInputStream</i>	521
<i>BufferedInputStream</i>	521
<i>DataInputStream</i>	522
<i>ObjectInputStream</i>	523
Quick Review	523
SEQUENTIAL CHARACTER STREAM FILE I/O USING READERS & WRITERS	524
<i>Writers</i>	524
<i>FileWriter</i>	524
<i>BufferedWriter</i>	525
<i>OutputStreamWriter</i>	526
<i>PrintWriter</i>	526
<i>Readers</i>	527
<i>FileReader</i>	527
<i>InputStreamReader</i>	527
<i>BufferedReader</i>	528
Quick Review	529
A PRACTICAL FILE I/O EXAMPLE: THE java.util.PROPERTIES CLASS	529
Quick Review	531
RANDOM ACCESS FILE I/O	531
Towards An Approach To The Adapter Project	533
Start Small And Take Baby Steps.....	533
Other Project Considerations	534
Locking A Record For Updates And Deletes	534
Translating Low-Level Exceptions Into Higher-Level Exception Abstractions.....	534
Where To Go From Here	534
Complete <i>RandomAccessFile</i> Legacy <i>Datafile</i> Adapter Source Code Listing	535
Quick Review	544

Quick File I/O COMBINATION REFERENCE	545
SUMMARY	546
SKILL-BUILDING EXERCISES	547
SUGGESTED PROJECTS	547
SELF-TEST QUESTIONS	548
REFERENCES	549
NOTES	549

PART V: NETWORK PROGRAMMING

19 INTRODUCTION TO NETWORKING AND DISTRIBUTED APPLICATIONS

INTRODUCTION	554
WHAT IS A COMPUTER NETWORK?	554
<i>PURPOSE OF A NETWORK</i>	554
<i>THE ROLE OF NETWORK PROTOCOLS</i>	555
<i>HOMOGENEOUS VS. HETEROGENEOUS NETWORKS</i>	555
<i>THE UNIFYING NETWORK PROTOCOLS: TCP/IP</i>	555
<i>WHAT'S SO SPECIAL ABOUT THE INTERNET?</i>	556
<i>QUICK REVIEW</i>	556
SERVERS & CLIENTS	557
<i>SERVER HARDWARE AND SOFTWARE</i>	557
<i>CLIENT HARDWARE AND SOFTWARE</i>	557
<i>QUICK REVIEW</i>	558
APPLICATION DISTRIBUTION	558
<i>PHYSICAL DISTRIBUTION ON ONE COMPUTER</i>	558
<i>RUNNING MULTIPLE JAVA VIRTUAL MACHINES ON THE SAME COMPUTER</i>	558
<i>STARTING MULTIPLE JVMs IN WINDOWS</i>	558
<i>STARTING MULTIPLE JVMs IN UNIX AND LINUX</i>	559
<i>RUNNING MULTIPLE CLIENTS ON THE SAME COMPUTER</i>	561
<i>ADDRESSING THE LOCAL MACHINE</i>	561
<i>PHYSICAL DISTRIBUTION ACROSS MULTIPLE COMPUTERS</i>	561
<i>MULTIPLE JAVA VIRTUAL MACHINES</i>	562
<i>QUICK REVIEW</i>	562
MULTI-TIERED APPLICATIONS	562
<i>LOGICAL APPLICATION TIERS</i>	562
<i>PHYSICAL TIER DISTRIBUTION</i>	563
<i>QUICK REVIEW</i>	564
INTERNET NETWORKING PROTOCOLS – NUTS & BOLTS	564
<i>THE INTERNET PROTOCOLS: TCP, UDP, AND IP</i>	564
<i>THE APPLICATION LAYER</i>	564
<i>TRANSPORT LAYER</i>	565
<i>NETWORK LAYER</i>	565
<i>DATA LINK & PHYSICAL LAYERS</i>	565
<i>PUTTING IT ALL TOGETHER</i>	566
<i>WHAT YOU NEED TO KNOW</i>	566
<i>QUICK REVIEW</i>	566
JAVA SUPPORT FOR NETWORK PROGRAMMING	567
<i>A NETWORK PROGRAMMING SCENARIO USING SOCKETS – OVERVIEW</i>	567
<i>THE URL CLASS</i>	568
<i>QUICK REVIEW</i>	569
REMOTE METHOD INVOCATION (RMI) OVERVIEW	569
<i>CREATING & RUNNING AN RMI APPLICATION IN JAVA 1.4.2</i>	570

REQUIRED STEPS	570
STEP 1: DEFINE A REMOTE INTERFACE.....	570
STEP 2: DEFINE A REMOTE INTERFACE IMPLEMENTATION.....	571
STEP 3: COMPILE THE REMOTE INTERFACE & REMOTE INTERFACE IMPLEMENTATION SOURCE FILES.....	571
STEP 4: USE THE RMIC TOOL TO GENERATE STUB CLASS	571
STEP 5: CREATE SERVER APPLICATION.....	572
STEP 6: CREATE CLIENT APPLICATION.....	573
STEP 7: START THE RMI REGISTRY.....	573
STEP 8: RUN THE SERVER APPLICATION.....	574
STEP 9: RUN THE CLIENT APPLICATION.....	574
CREATING & RUNNING AN RMI APPLICATION IN JAVA 1.5	575
CONSIDERATIONS WHEN DEPLOYING RMI APPLICATIONS IN MIXED JVM VERSION ENVIRONMENTS	575
SERVER JVM 1.5 - CLIENT JVM 1.5.....	575
SERVER JVM 1.5 - CLIENT JVM 1.4.2.....	575
SERVER JVM 1.4.2 - CLIENT JVM 1.5.....	575
SERVER JVM 1.4.2 - CLIENT JVM 1.4.2.....	575
Quick Review	576
SUMMARY	576
SKILL-BUILDING EXERCISES	577
SUGGESTED PROJECTS	578
SELF-TEST QUESTIONS	578
REFERENCES	579
NOTES	579

20 CLIENT-SERVER APPLICATIONS

INTRODUCTION	582
A SIMPLE SOCKET-BASED CLIENT-SERVER EXAMPLE	582
Simple SERVER Application	583
Simple CLIENT Application	585
RUNNING THE EXAMPLES	586
A FEW WORDS ABOUT PROTOCOL	588
Quick Review	588
PROJECT SPECIFICATION	588
CLIENT-SERVER PROJECT INITIAL DESIGN CONSIDERATIONS	589
NOUN-VERB ANALYSIS	589
HIGH-LEVEL APPLICATION OPERATIONS	590
HOW TO PROCEED	592
Quick Review	592
IMPLEMENTING NETRATSERVER – FIRST ITERATION	592
FIRST ITERATION CODE	593
TESTING THE FIRST ITERATION CODE	595
Quick Review	596
IMPLEMENTING NETRATSERVER - SECOND ITERATION	596
SECOND ITERATION CODE	597
TESTING SECOND ITERATION CODE	599
Quick Review	599
THE RMI-BASED CLIENT	600
TESTING MULTIPLE RMI CLIENTS	602
Quick Review	602
NETRATSERVER IMPLEMENTATION – THIRD ITERATION	602
UPDATED SERVER APPLICATION CLASS DIAGRAM	602
THIRD ITERATION CODE	603
TESTING THE THIRD ITERATION CODE	604
TESTING MULTIPLE RMI CLIENT APPLICATIONS	606
Quick Review	607

NETRATSERVER IMPLEMENTATION – FOURTH ITERATION	607
<i>FOURTH ITERATION CODE</i>	<i>608</i>
<i>TESTING FOURTH ITERATION CODE</i>	<i>610</i>
<i>TESTING THE FOURTH ITERATION CODE</i>	<i>613</i>
<i>QUICK REVIEW</i>	<i>613</i>
NETRATSERVER IMPLEMENTATION – FINAL ITERATION	613
<i>FINAL ITERATION CODE</i>	<i>615</i>
<i>TESTING THE FINAL ITERATION CODE</i>	<i>619</i>
<i>PARTING COMMENTS</i>	<i>619</i>
<i>QUICK REVIEW</i>	<i>620</i>
SUMMARY	620
SKILL-BUILDING EXERCISES	621
SUGGESTED PROJECTS	622
SELF-TEST QUESTIONS	622
REFERENCES	623
NOTES	623

21 Applets & JDBC

INTRODUCTION	626
APPLET OVERVIEW	626
<i>THE BENEFITS OF USING APPLETS</i>	<i>626</i>
<i><APPLET> VS. <OBJECT> TAGS</i>	<i>627</i>
<i>BROWSER JVM VS. JAVA PLUG-IN</i>	<i>627</i>
A BASIC APPLET EXAMPLE	627
<i>APPLET CODE</i>	<i>627</i>
<i>HTML PAGE CODE</i>	<i>628</i>
<i>PACKAGING AND DISTRIBUTION</i>	<i>628</i>
<i>RUNNING THE BASIC APPLET EXAMPLE</i>	<i>628</i>
<i>APPLET LIFE-CYCLE STAGES.....</i>	<i>629</i>
<i>THE <APPLET> TAG IN DETAIL</i>	<i>630</i>
<i>QUICK REVIEW</i>	<i>631</i>
APPLET SECURITY RESTRICTIONS	631
<i>MISCELLANEOUS APPLET SECURITY RESTRICTIONS</i>	<i>634</i>
<i>SECURITY POLICIES & SIGNED APPLETS</i>	<i>634</i>
<i>QUICK REVIEW</i>	<i>634</i>
USING APPLET PARAMETERS	634
<i>QUICK REVIEW</i>	<i>636</i>
EXTENDED APPLET EXAMPLE – POETRY IN BROWSER	636
JAVA DATABASE CONNECTIVITY (JDBC™) OVERVIEW	639
<i>JDBC™ PACKAGES</i>	<i>639</i>
<i>JDBC™ SPECIFICATION</i>	<i>639</i>
<i>USING JDBC – A MACRO VIEW</i>	<i>640</i>
<i>PROPERLY CONFIGURED DATABASE.....</i>	<i>640</i>
<i>JDBC DRIVER CLASS.....</i>	<i>640</i>
<i>KNOWLEDGE OF RELATIONAL DATABASE DESIGN</i>	<i>640</i>
<i>KNOWLEDGE OF THE DATABASE SCHEMA</i>	<i>640</i>
<i>KNOWLEDGE OF SQL.....</i>	<i>640</i>
<i>THE JAVA JDBC PROGRAM</i>	<i>640</i>
<i>GENERAL STEPS REQUIRED TO EMPLOY JDBC</i>	<i>641</i>
<i>MOVING FORWARD</i>	<i>641</i>
<i>QUICK REVIEW</i>	<i>641</i>
JDBC PROJECT DESCRIPTION	641
<i>OVERALL SYSTEM ARCHITECTURE</i>	<i>641</i>
<i>DETAILED SYSTEM ARCHITECTURE</i>	<i>641</i>
<i>ROLE OF THE PERSISTENT CLASS</i>	<i>643</i>

Quick Review	643
MySQL DATABASE & JDBC	643
Setting Up MySQL To Run The Example Code	643
Obtaining And Installing MySQL	644
The mysqladmin Program.....	644
The mysql Monitor Program.....	645
Helpful MySQL Monitor Commands.....	646
Creating The chapter_21 Database	647
Establishing Database Security Via MySQL Access Control Tables.....	647
General Strategy For Managing Permissions Using The MySQL Access Control Tables	649
Creating The Employee Training Management System Tables.....	650
Populating Tables with Data and Running Queries	651
Inserting Data Into Tables.....	651
Querying A Table with the select Statement.....	652
Updating Data In A Table.....	652
Joining Tables With A Select Statement.....	652
Accessing chapter_21 Database Tables Via JDBC	654
A Short JDBC Example Program.....	654
Accessing ResultSet Metadata.....	655
Quick Review	656
Extended Applet & JDBC Example	656
The Code	656
Compiling And Packaging The Applet Code For Distribution	667
Running The Example	668
Start MySQL Database Application.....	668
Start The DBServerApp Program.....	668
Access The employeetraining.html Page.....	668
Using The Employee Training Applet.....	668
Code Discussion	670
Employee And EmployeeTraining Classes.....	670
AddNewEmployeeDialog And AddTrainingRecordDialog Classes.....	671
EmployeeTrainingApplet Class	671
DBServerApp Class	671
Persister Class.....	671
DBServerProperties	671
Statements vs. Prepared Statements	672
SUMMARY	672
Skill-Building Exercises	673
Suggested Projects	674
Self-Test Questions	675
REFERENCES	675
NOTES	676

PART VI: OBJECT-ORIENTED DESIGN

22 INHERITANCE, COMPOSITION, INTERFACES, POLYMORPHISM

INTRODUCTION	680
INHERITANCE VS. COMPOSITION: THE GREAT DEBATE	680
What's The End Game?	681
Flexible Application Architectures.....	681
Modularity And Reliability.....	681
Architectural Stability Via Managed Dependencies	681

<i>Knowing When To Accept A Design That's Good Enough</i>	682
<i>Quick Review</i>	682
INHERITANCE-BASED DESIGN	682
<i>THREE GOOD REASONS TO USE INHERITANCE</i>	682
<i>AS A MEANS TO REASON ABOUT CODE BEHAVIOR</i>	682
<i>TO GAIN A MEASURE OF CODE REUSE</i>	682
<i>TO FACILITATE INCREMENTAL DEVELOPMENT</i>	682
<i>FORMS OF INHERITANCE: MEYER'S INHERITANCE TAXONOMY</i>	683
<i>COAD'S INHERITANCE CRITERIA</i>	684
<i>PERSON - EMPLOYEE EXAMPLE REVISITED</i>	685
<i>Quick Review</i>	685
THE ROLE OF INTERFACES	686
<i>REDUCING OR LIMITING INTERMODULE DEPENDENCIES</i>	686
<i>MODELING DOMINANT, COLLATERAL, AND DYNAMIC ROLES</i>	686
<i>DOMINANT ROLES</i>	687
<i>COLLATERAL ROLES</i>	687
<i>DYNAMIC ROLES</i>	687
<i>Quick Review</i>	687
Applied Polymorphism	687
<i>Quick Review</i>	688
Composition-Based Design As A Force Multiplier	688
<i>TWO TYPES OF AGGREGATION</i>	688
<i>POLYMORPHIC CONTAINMENT</i>	688
<i>AN EXTENDED EXAMPLE</i>	689
<i>Quick Review</i>	693
SUMMARY	693
Skill-Building Exercises	694
SUGGESTED PROJECTS	695
SELF-TEST QUESTIONS	696
REFERENCES	696
NOTES	697

23 Well-Behaved Objects

INTRODUCTION	700
CONSIDER OBJECT USAGE FROM THE START	700
<i>Applying THE OBJECT USAGE SCENARIO CHECKLIST</i>	701
<i>Quick Review</i>	702
OVERRIDING java.lang.Object METHODS	703
<i>OVERRIDING toString()</i>	703
<i>OVERRIDING equals() AND hashCode()</i>	703
<i>equals() METHOD</i>	703
<i>TESTING PERSON.toString() AND PERSON.equals() METHODS</i>	705
<i>hashCode() METHOD</i>	705
<i>OVERRIDING hashCode() IN THE PERSON CLASS</i>	707
<i>TESTING PERSON.hashCode()</i>	707
<i>OVERRIDING clone()</i>	708
<i>SHALLOW COPY VS. DEEP COPY</i>	708
<i>OVERRIDING PERSON.clone()</i>	709
<i>OVERRIDING finalize() – AND AN ALTERNATIVE APPROACH</i>	710
<i>Quick Review</i>	710
IMPLEMENTING THE java.lang.Comparable INTERFACE	711
<i>Quick Review</i>	712
Using PERSON OBJECTS IN A COLLECTION	713
IMPLEMENTING java.util.Comparator INTERFACE	713
<i>Quick Review</i>	715

IMPLEMENTING THE SERIALIZABLE INTERFACE	716
PERSON CLASS – THE FINAL VERSION	716
SUMMARY	717
SKILL-BUILDING EXERCISES	718
SUGGESTED PROJECTS	718
SELF-TEST QUESTIONS	718
REFERENCES	719
NOTES	719

24 THREE DESIGN PRINCIPLES

INTRODUCTION	722
THE PREFERRED CHARACTERISTICS OF AN OBJECT-ORIENTED ARCHITECTURE	722
<i>EASY TO UNDERSTAND – (HOW DOES THIS THING WORK?)</i>	722
<i>EASY TO REASON ABOUT – (WHAT ARE THE EFFECTS OF CHANGE?)</i>	722
<i>EASY TO EXTEND – (WHERE DO I ADD FUNCTIONALITY?)</i>	722
THE LISKOV SUBSTITUTION PRINCIPLE & DESIGN BY CONTRACT	723
<i>REASONING ABOUT THE BEHAVIOR OF SUPERTYPES AND SUBTYPES</i>	723
<i>RELATIONSHIP BETWEEN THE LSP AND DbC</i>	723
<i>THE COMMON GOAL OF THE LSP AND DbC</i>	723
<i>JAVA SUPPORT FOR THE LSP AND DbC</i>	723
<i>DESIGNING WITH THE LSP/DbC IN MIND</i>	724
<i>CLASS DECLARATIONS VIEWED AS BEHAVIOR SPECIFICATIONS</i>	724
<i>Quick Review</i>	724
PRECONDITIONS, POSTCONDITIONS, AND CLASS INVARIANTS	724
<i>CLASS INVARIANT</i>	724
<i>PRECONDITION</i>	724
<i>POSTCONDITION</i>	725
<i>AN EXAMPLE</i>	725
<i>A NOTE ON USING ASSERTIONS TO ENFORCE PRE- AND POSTCONDITIONS</i>	726
<i>USING INCREMENTER AS A BASE CLASS</i>	726
<i>CHANGING THE PRECONDITIONS OF DERIVED CLASS METHODS</i>	728
<i>CHANGING THE POSTCONDITIONS OF DERIVED CLASS METHODS</i>	731
<i>SPECIAL CASES OF PRECONDITIONS AND POSTCONDITIONS</i>	732
<i>METHOD ARGUMENT TYPES</i>	732
<i>METHOD RETURN TYPES</i>	735
<i>THREE RULES OF THE SUBSTITUTION PRINCIPLE</i>	735
<i>SIGNATURE RULE</i>	735
<i>METHODS RULE</i>	735
<i>PROPERTIES RULE</i>	735
<i>Quick Review</i>	735
THE OPEN-CLOSED PRINCIPLE	735
<i>ACHIEVING THE OPEN-CLOSED PRINCIPLE</i>	736
<i>AN OCP EXAMPLE</i>	736
<i>Quick Review</i>	739
THE DEPENDENCY INVERSION PRINCIPLE	740
<i>CHARACTERISTICS OF BAD SOFTWARE ARCHITECTURE</i>	740
<i>CHARACTERISTICS OF GOOD SOFTWARE ARCHITECTURE</i>	741
<i>SELECTING THE RIGHT ABSTRACTIONS TAKES EXPERIENCE</i>	741
<i>Quick Review</i>	741
TERMS AND DEFINITIONS	741
SUMMARY	742
SKILL-BUILDING EXERCISES	743
SUGGESTED PROJECTS	743
SELF-TEST QUESTIONS	743
REFERENCES	744

NOTES 744

25 Helpful Design PATTERNS

INTRODUCTION 746

SOFTWARE DESIGN PATTERNS AND HOW THEY CAME TO BE 746

WHAT EXACTLY IS A SOFTWARE DESIGN PATTERN? 746

ORIGINS 746

PATTERN SPECIFICATION 747

APPLYING SOFTWARE DESIGN PATTERNS 747

QUICK REVIEW 747

THE SINGLETON PATTERN 748

QUICK REVIEW 749

THE FACTORY PATTERN 749

THE DYNAMIC FACTORY 750

ADVANTAGES OF THE DYNAMIC FACTORY PATTERN 751

QUICK REVIEW 751

THE MODEL-VIEW-CONTROLLER PATTERN 751

POTENTIAL ISSUES WITH ONE ACTIONLISTENER 753

QUICK REVIEW 753

THE COMMAND PATTERN 753

QUICK REVIEW 756

A COMPREHENSIVE PATTERN-BASED EXAMPLE 756

Code Listing By Package Name 756

com.pulpfreepress.commands 756

com.pulpfreepress.controller 759

com.pulpfreepress.exceptions 760

com.pulpfreepress.interfaces 760

com.pulpfreepress.model 761

com.pulpfreepress.utils 767

com.pulpfreepress.view 769

SUMMARY 776

SKILL-BUILDING EXERCISES 777

SUGGESTED PROJECTS 777

SELF-TEST QUESTIONS 777

REFERENCES 778

NOTES 778

APPENDICES

Appendix A: Helpful Checklists And Tables

PROJECT-APPROACH STRATEGY Check-off List 781

DEVELOPMENT CYCLE 782

Appendix B: ASCII Table

ASCII Table 783

List of Tables

Table 1-1: JAVA SOURCE FILE RULES SUMMARY	17
Table 1-2: CLASS NAMING EXAMPLES	21
Table 1-3: CONSTANT NAMING EXAMPLES	21
Table 1-4: VARIABLE NAMING EXAMPLES	21
Table 1-5: METHOD NAMING EXAMPLES	22
Table 2-1: HELPFUL OPERATING SYSTEM COMMANDS	56
Table 3-1: PROJECT APPROACH STRATEGY	60
Table 3-2: DEVELOPMENT CYCLE	61
Table 3-3: PROJECT SPECIFICATION	62
Table 3-4: ROBOT RAT NOUNS AND VERBS	64
Table 3-5: LANGUAGE FEATURE STUDY CHECK-OFF LIST FOR ROBOT RAT PROJECT	66
Table 3-6: FIRST ITERATION DESIGN CONSIDERATIONS	69
Table 3-7: SECOND ITERATION DESIGN CONSIDERATIONS	71
Table 3-8: THIRD ITERATION DESIGN CONSIDERATIONS	72
Table 3-9: FOURTH ITERATION DESIGN CONSIDERATIONS	76
Table 3-10: FIFTH ITERATION DESIGN CONSIDERATIONS	80
Table 3-11: FINAL PROJECT REVIEW CHECKLIST	83
Table 5-1: JAVA PLATFORM PACKAGES USED IN THIS BOOK	116
Table 6-1: TERMS AND DEFINITIONS TO GET YOU STARTED	122
Table 6-2: RESERVED JAVA KEYWORDS	127
Table 6-3: JAVA PRIMITIVE DATA TYPES	129
Table 6-4: JAVA OPERATORS	139
Table 6-5: PRIMITIVE TYPE WRAPPER CLASSES	149
Table 7-1: JAVA SELECTION AND ITERATION STATEMENT SELECTION GUIDE	171
Table 8-1: JAVA ARRAY PROPERTIES	183
Table 8-2: JAVA API CLASSES AND INTERFACES REFERENCED IN CHAPTER 8	202
Table 8-3: EISCS MACHINE INSTRUCTIONS	205
Table 9-1: PEOPLE MANAGER PROGRAM CLASS RESPONSIBILITIES	212
Table 9-2: JAVA METHOD MODIFIER KEYWORDS	218
Table 11-1: DIFFERENCES BETWEEN ABSTRACT CLASSES AND INTERFACES	280
Table 11-2: CHAPTER 11 TERMS AND DEFINITIONS	297
Table 12-1: JAVA.AWT.COMPONENT.SETBOUNDS() METHODS	311
Table 12-2: TOP-LEVEL CONTAINERS CONSTRUCTOR CHART	312
Table 12-3: METHODS AVAILABLE TO ALL DESCENDANTS OF WINDOW	314
Table 12-4: METHODS AVAILABLE TO FRAME, JFRAME, Dialog, JDialog ONLY	314
Table 12-5: METHODS AVAILABLE TO FRAME, JFRAME ONLY	315
Table 12-6: METHODS AVAILABLE TO JWindow, JFRAME, JDialog ONLY	315
Table 12-7: METHODS AVAILABLE TO JFRAME, JDialog ONLY	315
Table 12-8: GridBagConstraints Fields and Their Default Values	326
Table 12-9: TOP-LEVEL COMPONENTS FOR CONTAINING OTHER COMPONENTS	330
Table 12-10: NON TOP-LEVEL COMPONENTS FOR CONTAINING OTHER COMPONENTS	330
Table 12-11: COMPONENTS THAT ALLOW THE SELECTION OF A VALUE FROM A DISCRETE SET OF VALUES	330
Table 12-12: COMPONENTS THAT ALLOW THE SELECTION OF A VALUE FROM A VIRTUAL CONTINUUM OF VALUES	330
Table 12-13: COMPONENTS THAT ALLOW THE USER TO INITIATE AN ACTION	331
Table 12-14: COMPONENTS THAT REPRESENT A BOOLEAN VALUE	331
Table 12-15: COMPONENTS FOR ENTERING TEXT	331
Table 12-16: VIEW-ONLY COMPONENTS	331
Table 12-17: APPEARANCE-RELATED COMPONENT METHODS	332
Table 12-18: SIZE- AND LOCATION-RELATED COMPONENT METHODS	333
Table 12-19: VISIBILITY-RELATED COMPONENT METHODS	334

Table 12-20: CONTAINMENT HIERARCHY-RELATED COMPONENT METHODS	334
Table 12-21: OTHER PROPERTY-RELATED COMPONENT METHODS	334
Table 12-22: APPEARANCE-RELATED CONTAINER METHODS	335
Table 12-23: CONTAINMENT HIERARCHY-RELATED CONTAINER METHODS	335
Table 12-24: APPEARANCE-RELATED JCOMPONENT METHODS	336
Table 12-25: SIZE- AND LOCATION-RELATED JCOMPONENT METHODS	336
Table 12-26: VISIBILITY-RELATED JCOMPONENT METHODS	336
Table 12-27: CONTAINMENT HIERARCHY-RELATED JCOMPONENT METHODS	337
Table 12-28: OTHER PROPERTY-RELATED JCOMPONENT METHODS	337
Table 13-1: EVENTOBJECT METHODS	351
Table 13-2: COMPONENT METHODS FOR MANAGING EVENT LISTENERS	351
Table 13-3: JBUTTON'S EVENTLISTENER REGISTRATION METHODS	352
Table 13-4: LISTENERS AND EVENT TYPES FOR JMENUITEM	355
Table 13-5: ACTIONEVENT EVENT IDS	356
Table 13-6: ACTIONEVENT CONSTANTS	356
Table 13-8: ACTIONLISTENER METHODS	357
Table 13-7: ACTIONEVENT PROPERTIES	357
Table 13-9: COMPONENTEVENT METHODS	359
Table 13-10: INPUTEVENT METHODS	359
Table 13-11: INPUTEVENT CONVENIENCE METHODS	359
Table 13-12: MOUSEEVENT EVENT IDS	360
Table 13-13: MOUSEEVENT-SPECIFIC METHODS	360
Table 13-14: SWINGUTILITIES HELPER METHODS	361
Table 13-15: MOUSELISTENER METHODS	361
Table 13-16: MOUSEMOTIONLISTENER METHODS	362
Table 13-17: MOUSEWHEELLISTENER METHODS	362
Table 13-18: KEYEVENT EVENT IDS	365
Table 13-19: KEYEVENT METHODS	365
Table 13-20: KEYLISTENER METHODS	366
Table 13-21: CHANGETLISTENER METHODS	372
Table 13-22: LISTSELECTIONEVENT METHODS	373
Table 13-23: LISTSELECTIONLISTENER METHODS	374
Table 14-1: COMPONENT'S PAINTING METHOD	384
Table 14-2: JCOMPONENT'S PAINTING METHODS	385
Table 14-3: REPAINT METHODS DEFINED BY COMPONENT	385
Table 14-4: REPAINT METHODS DEFINED BY JCOMPONENT	386
Table 14-5: LISTMODEL METHODS	390
Table 14-6: JLIST'S LISTMODEL METHODS	390
Table 14-7: JLIST'S, JTREE'S AND JCOMBOBOX'S RENDERER-RELATED METHODS	393
Table 14-8: JTABLE'S RENDERER-RELATED METHODS	393
Table 14-9: JTREE'S EDITOR-RELATED METHODS	409
Table 14-10: JTABLE'S AND TABLECOLUMN'S EDITOR-RELATED METHODS	409
Table 14-11: JAVAX.SWING.CELLEDITOR METHODS	409
Table 14-12: DRAGINDEX, DRAGITEM AND DRAGRECT ATTRIBUTES	415
Table 14-13: DRAGSTART, DRAGTHRESHOLD AND ALLOWDRAG ATTRIBUTES	415
Table 14-14: DELTAY AND INDRAG ATTRIBUTES	416
Table 14-15: HOW THE INDRAG ATTRIBUTE IS USED	416
Table 15-1: HELPFUL THROWABLE METHODS	433
Table 16-1: GETTING THE CURRENT THREAD	447
Table 16-2: SLEEPING AND INTERRUPTING	447
Table 16-3: CHECKING THE INTERRUPTED STATUS	448
Table 16-4: THREAD CONSTRUCTORS	449
Table 16-5: STARTING A THREAD	449
Table 16-6: CALLING THE THREAD.yield() METHOD	455
Table 16-7: THREAD'S PRIORITY-RELATED METHODS	455
Table 16-8: THREADGROUP'S PRIORITY-RELATED METHODS	456
Table 16-9: THREAD'S join() METHODS	458
Table 16-10: OBJECT'S Wait() AND Notify() METHODS	470
Table 17-1: CORE COLLECTION INTERFACE CHARACTERISTICS	487

Table 17-2: NEW JAVA 5 CORE COLLECTION INTERFACES	500
Table 18-1: JAVA FILE I/O CLASSES BY CONSTRUCTOR ARGUMENT TYPE	511
Table 18-2: JAVA I/O CLASSES ORGANIZED BY FILE-TERMINAL, INTERMEDIATE, OR USER-FRONTING CHARACTERISTIC	512
Table 18-3: HANDY java.io CLASS COMBINATION REFERENCE	545
Table 20-1: CLIENT-SERVER PROJECT SPECIFICATION	588
Table 20-3: CLASS RESPONSIBILITY ASSIGNMENT	590
Table 20-2: CLIENT-SERVER PROJECT NOUN-VERB ANALYSIS	590
Table 20-4: FIRST ITERATION DESIGN CONSIDERATIONS AND DECISIONS	592
Table 20-5: SECOND ITERATION DESIGN CONSIDERATIONS AND DECISIONS	596
Table 20-6: THIRD ITERATION DESIGN CONSIDERATIONS AND DECISIONS	602
Table 20-7: THIRD ITERATION DESIGN CONSIDERATIONS AND DECISIONS	607
Table 20-8: FINAL ITERATION DESIGN CONSIDERATIONS AND DECISIONS	613
Table 21-1: HELPFUL MySQL MONITOR COMMANDS	646
Table 21-2: EMPLOYEE TRAINING MANAGEMENT SYSTEM CLASS DESCRIPTIONS	657
Table 22-1: INHERITANCE FORM DESCRIPTIONS	683
Table 23-1: OBJECT USAGE SCENARIO EVALUATION CHECKLIST	700
Table 23-2: APPLYING THE OBJECT USAGE SCENARIO EVALUATION CHECKLIST	701
Table 23-3: equals() METHOD EQUIVALENCE RELATION	703
Table 23-4: BLOCH'S equals() METHOD CRITERIA	704
Table 23-5: THE hashCode() GENERAL CONTRACT	706
Table 24-1: TERMS AND DEFINITIONS RELATED TO THE LSP	741
Table 25-1: PATTERN SPECIFICATION TEMPLATE	747
Table Appendix A-1: PROJECT APPROACH STRATEGY	781
Table Appendix A-2: DEVELOPMENT CYCLE	782
Table Appendix B-1: ASCII TABLE	783

