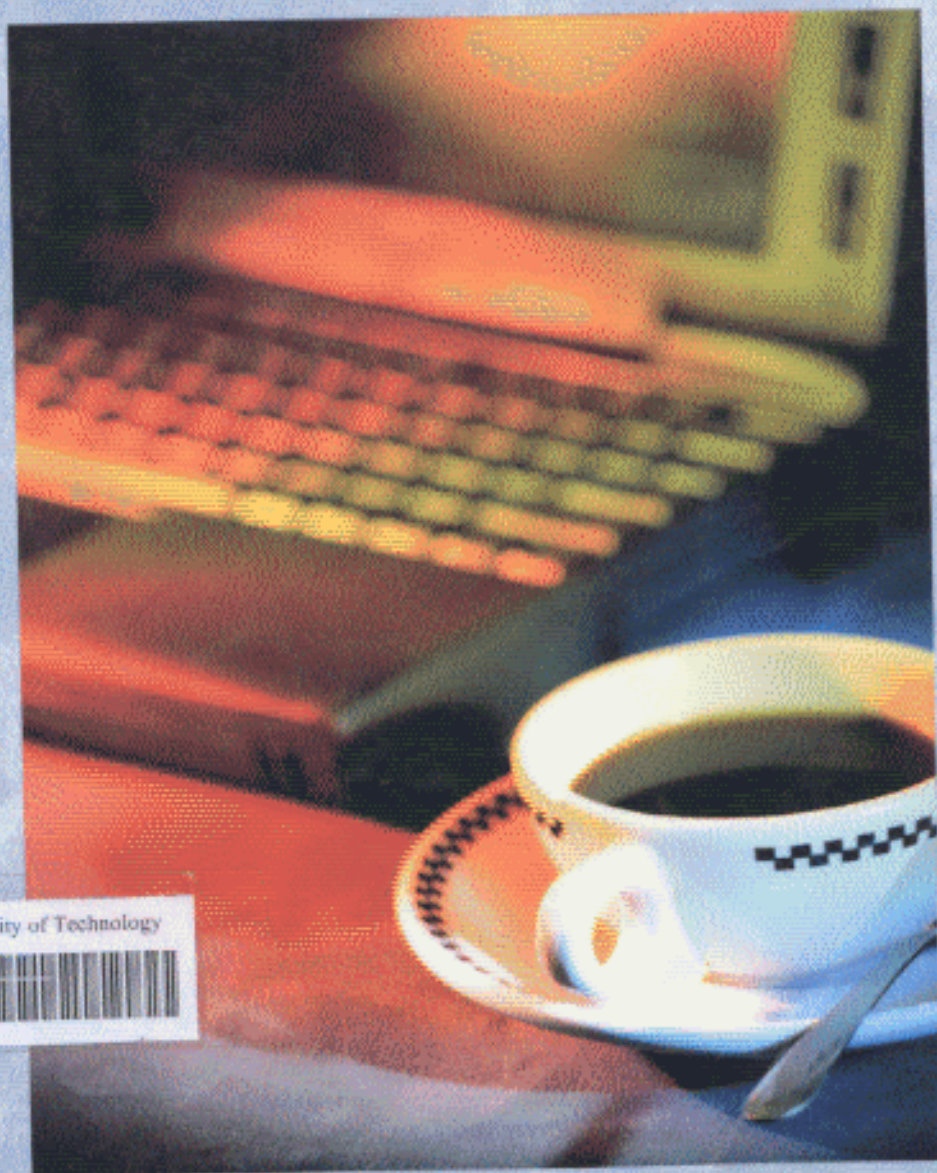


Introduction to

JAVA™ Programming

with MICROSOFT® Visual J++ 6.0



Suranaree University of Technology



31051000605457

Y. DANIEL LIANG

CONTENTS AT A GLANCE

PART I	FUNDAMENTALS OF JAVA PROGRAMMING	1
Chapter 1.	Introduction to Java and Visual J++ 6	1
Chapter 2.	Java Building Elements	45
Chapter 3.	Control Structures	79
Chapter 4.	Methods	111
PART II	OBJECT-ORIENTED PROGRAMMING	139
Chapter 5.	Programming with Objects and Classes	141
Chapter 6.	Arrays and Strings	185
Chapter 7.	Class Inheritance	231
PART III	GRAPHICS PROGRAMMING	281
Chapter 8.	Getting Started with Graphics Programming	283
Chapter 9.	Creating User Interfaces	343
Chapter 10.	Applets and Advanced Graphics	417
PART IV	DEVELOPING COMPREHENSIVE PROJECTS	475
Chapter 11.	Exception Handling	477
Chapter 12.	Internationalization	509
Chapter 13.	Multithreading	543
Chapter 14.	Multimedia	575
Chapter 15.	Input and Output	603
Chapter 16.	Networking	649
	APPENDIXES	677
Appendix A.	Java Keywords	679
Appendix B.	The ASCII Character Set	681
Appendix C.	Operator Precedence Chart	685
Appendix D.	Java Modifiers	689
Appendix E.	An HTML Tutorial	691
Appendix F.	Using the Companion CD-ROM and Installing the Swing Library	709
Appendix G.	Rapid Java Application Development Using Visual J++ 6	713
Appendix H.	Glossary	731

TABLE OF CONTENTS

PART I FUNDAMENTALS OF JAVA PROGRAMMING	1
Introduction to Java and Visual J++ 6	3
Objectives	3
Introduction	4
The History of Java	4
Characteristics of Java	4
Java is Simple	5
Java is Object-Oriented	5
Java is Distributed	6
Java is Interpreted	6
Java is Robust	7
Java is Secure	7
Java is Architecture-Neutral	7
Java is Portable	8
Java's Performance	8
Java is Multithreaded	8
Java is Dynamic	9
Java and the World Wide Web	9
The Java Language Specification	10
Java Development Tools and Visual J++ 6.0	11
Getting Started with Visual J++	12
Creating a Project	13
Menu Bar and Toolbar	15
Visual J++ IDE Windows	17
Java Applications	23
Creating a Java Program	24
Compiling and Executing a Java Program	28
Anatomy of the Application Program	30
Comments	30
Reserved Words	30
Modifiers	31
Statements	31
Blocks	31
Classes	31
Methods	32
The <i>main()</i> Method	32

Java Applets	32
Creating and Compiling an Applet	33
Creating an HTML File	34
Viewing Applets	37
Anatomy of the Applet Program	39
The <i>import</i> Statement	39
Class Instance	40
The <i>paint()</i> Method and the <i>Graphics</i> Class	40
The <i>extends</i> Keyword and Class Inheritance	41
Applications versus Applets	42
Chapter Summary	42
Chapter Review	43
Programming Exercises	44
Java Building Elements	45
Objectives	45
Introduction	46
Writing Simple Programs	46
Identifiers	49
Variables	50
Declaring Variables	50
Assignment Statements	50
Declaring and Initializing Variables in One Step	51
Constants	52
Numerical Data Types	52
Numeric Literals	53
Shortcut Operators	53
Numeric Type Conversion	54
Character Data Type	55
<i>boolean</i> Data Type	57
Operator Precedence	59
Programming Errors	60
Compilation Errors	60
Runtime Errors	63
Logic Errors	64
Programming Style and Documentation	64
Appropriate Comments	64
Naming Conventions	65
Proper Indentation	65
Block Styles	66

Separate Classes	66
Case Studies	67
Visual J++'s Online Help	71
Visual J++ IDE Options	74
Chapter Summary	75
Chapter Review	76
Programming Exercises	78

CHAPTER 3

Control Structures	79
Objectives	79
Introduction	80
Using <i>if</i> Statements	80
The Simple <i>if</i> Statement	80
The <i>if</i> . . . <i>else</i> Statement	81
Nested <i>if</i> Statements	82
Running Example 3.1 in Visual J++ 6	85
Shortcut <i>if</i> Statements	87
Using <i>switch</i> Statements	87
Using Loop Structures	89
The <i>for</i> Loop	89
The <i>while</i> Loop	94
The <i>do</i> Loop	96
Using the Keywords <i>break</i> and <i>continue</i>	97
Case Studies	101
Chapter Summary	104
Chapter Review	105
Programming Exercises	107

CHAPTER 4

Methods	111
Objectives	111
Introduction	112
Creating a Method	112
Calling a Method	113
Passing Parameters	115
Pass by Value	116
Overloading Methods	117
Creating Methods in Separate Classes	119
Method Abstraction	120
Recursion (Optional)	126
Recursion versus Iteration (Optional)	133

Chapter Summary	134
Chapter Review	135
Programming Exercises	136

PART II OBJECT-ORIENTED PROGRAMMING 139

CHAPTER 13	Programming with Objects and Classes	141
	Objectives	141
	Introduction	142
	Objects and Classes	142
	Declaring and Creating Objects	143
	Constructors	147
	Modifiers	150
	Passing Objects to Methods	152
	Instance Variables and Class Variables	157
	Instance Methods and Class Methods	161
	The Scope of Variables	162
	Case Studies	163
	Packages	170
	Package-Naming Conventions	171
	The CLASSPATH Environment Variable	171
	Putting Classes into Packages	172
	Using Packages	174
	Java Application Programmer Interface	175
	The <i>Math</i> Class	177
	Trigonometric Methods	177
	Exponent Methods	177
	The <i>min()</i> , <i>max()</i> , <i>abs()</i> , and <i>random()</i> Methods	178
	Chapter Summary	178
	Chapter Review	179
	Programming Exercises	182
CHAPTER 14	Arrays and Strings	185
	Objectives	185
	Introduction	186
	Declaring and Creating Arrays	186
	Initializing and Processing Arrays	187
	Sorting Arrays	190
	Searching Arrays	193
	The Linear Search Approach	193
	The Binary Search Approach (Optional)	195

Array of Objects	198
Copying Arrays	199
Multidimensional Arrays	202
The <i>String</i> Class	205
String Comparisons	205
String Concatenation	206
Substrings	206
String Length and Retrieving Individual Characters in a String	207
The <i>StringBuffer</i> Class	207
Appending and Inserting New Contents into a <i>StringBuffer</i>	208
The <i>capacity()</i> , <i>reverse()</i> , <i>length()</i> , <i>setLength()</i> , <i>charAt()</i> , and <i>setCharAt()</i> Methods	208
The <i>StringTokenizer</i> Class	210
Command-Line Arguments	212
Passing Arguments to Java Programs	212
Processing Command-Line Parameters	213
Debugging in Visual J++	215
Starting the Debugger	216
Controlling Program Execution	218
Setting breakpoints	219
Inspecting and Modifying Data Values	220
Debugging <i>TestSelectionSortWithError</i>	223
Chapter Summary	225
Chapter Review	226
Programming Exercises	228
CHAPTER 7 Class Inheritance	231
Objectives	231
Introduction	232
Superclasses and Subclasses	232
Using the Keyword <i>super</i>	234
Calling Superclass Constructors	234
Calling Superclass Methods	234
Overriding Methods	235
The Keyword <i>this</i>	237
The <i>protected</i> , <i>final</i> , and <i>abstract</i> Modifiers	238
The <i>protected</i> Modifier	238
The <i>final</i> Modifier	239
The <i>abstract</i> Modifier	239

Polymorphism	242
Casting Objects	243
The <i>Object</i> class	247
The <i>equals()</i> Method	248
The <i>toString()</i> method	248
The <i>clone()</i> Method	249
Processing Primitive Type Values as Objects	249
The <i>Number</i> Class and Its Subclasses	250
Numeric Wrapper Class Constructors	251
Numeric Wrapper Class Constants	251
Conversion Methods	251
The <i>valueOf()</i> , <i>parseInt()</i> , and <i>parseDouble()</i> Methods	252
Class-Design Guidelines	252
Case Studies (Optional)	253
Interfaces	261
Inner Classes	266
Adding New Classes, Methods, and Data to Classes in Visual J++	267
Overriding a Method in the Superclass	272
Chapter Summary	274
Chapter Review	275
Programming Exercises	278

PART III GRAPHICS PROGRAMMING 281

CHAPTER 1	Getting Started with Graphics Programming	283
	Objectives	283
	Introduction	284
	The Java Graphics Class Hierarchy	285
	Creating a Frame	288
	Event-Driven Programming	289
	Event and Event Source	290
	Event Registration, Listening, and Handling	291
	Handling Events	293
	Adapters and Anonymous Inner Classes (Optional)	302
	Layout Managers	305
	<i>FlowLayout</i>	306
	<i>GridLayout</i>	308
	<i>BorderLayout</i>	310

Using Panels as Containers	312
Using Panels to Draw Graphics	314
The <i>repaint()</i> , <i>update()</i> , <i>paint()</i> , and <i>paintComponent()</i> Methods	317
The <i>Color</i> Class	318
Drawing Geometric Figures	318
The <i>Font</i> and <i>FontMetrics</i> Classes	319
Drawing Lines	324
Drawing Rectangles	324
Ovals	327
Arcs	329
Polygons	330
Case Studies	333
Chapter Summary	337
Chapter Review	337
Programming Exercises	339

CHAPTER 34

Creating User Interfaces	343
Objectives	343
Introduction	344
JavaBeans	344
Buttons	347
Labels	352
Text Fields	354
Text Areas	357
Combo Boxes	360
Lists	364
Check Boxes	367
Radio Buttons	370
Borders	375
Message Dialog Boxes	382
Menus	386
Image Icons, Keyboard Mnemonics, and Keyboard Accelerators	389
Creating Multiple Windows	394
Scrollbars	396
Scroll Panes	400
Tabbed Panes	405
Chapter Summary	409

Chapter Review	410
Programming Exercises	411
CHAPTER 10 Applets and Advanced Graphics	417
Objectives	417
Introduction	418
The <i>Applet</i> Classes	418
The <i>init()</i> method	419
The <i>start()</i> method	419
The <i>stop()</i> method	420
The <i>destroy()</i> method	420
The <i>JApplet</i> Class	420
The <i><applet></i> HTML Tag	424
Running Applets in the Java Plug-In (Optional)	425
Passing Parameters to Applets	428
Conversions between Applications and Applets	431
Running a Program as an Applet and an Application	437
Mouse Events	441
Keyboard Events	445
Case Studies	448
The <i>CardLayout</i> Manager (Optional)	455
The <i>GridBagLayout</i> Manager (Optional)	458
Using No Layout Manager (Optional)	462
Packaging and Deploying Visual J++ Projects (Optional)	465
Packaging and Deploying as .exe files	465
Packaging and Deploying as .zip files	467
Chapter Summary	467
Chapter Review	468
Programming Exercises	469
PART IV DEVELOPING COMPREHENSIVE PROJECTS	475
CHAPTER 11 Exception Handling	477
Objectives	477
Introduction	478
Exceptions and Exception Types	478
Understanding Exception Handling	480
Claiming Exceptions	480

Throwing Exceptions	481
Catching Exceptions	482
Creating Custom Exception Classes	487
Rethrowing Exceptions	494
The <i>finally</i> Clause	495
Cautions When Using Exceptions	495
Chapter Summary	498
Chapter Review	499
Programming Exercises	506

Chapter 13 Internationalization

Objectives	509
Introduction	510
<i>Locale</i>	510
Processing Date and Time	513
Formatting Numbers	527
Resource Bundles (Optional)	532
Chapter Summary	540
Review Questions	540
Exercises	540

Chapter 14 Multithreading

Objectives	543
Introduction	544
The <i>Thread</i> Class	545
Debugging Multithreaded Applications in Visual J++	549
The <i>Runnable</i> Interface	551
Case Studies	557
Thread States	562
Thread Priority	563
Thread Groups	565
Synchronization	565
Chapter Summary	570
Chapter Review	570
Programming Exercises	571

Chapter 15 Multimedia

Objectives	575
Introduction	576
Playing Audio	576
Running Audio on a Separate Thread	581

Displaying Images	583
Loading Image and Audio Files in Java Applications	586
Displaying a Sequence of Images	591
Using MediaTracker	595
Chapter Summary	598
Chapter Review	598
Programming Exercises	599

CHAPTER 14 Input and Output 603

Objectives	603
Introduction	604
Stream Classes	605
<i>InputStream</i> and <i>Reader</i>	606
<i>OutputStream</i> and <i>Writer</i>	607
Processing External Files	608
Array Streams	611
Filter Streams	611
Data Streams	612
Print Streams	616
Buffered Streams	618
Parsing Text Files	622
Random Access Files	625
File Dialogs	636
Interactive Input and Output	641
Piped Streams, String Streams, Pushback Streams, Line Number Streams, and Object Streams	643
Chapter Summary	644
Chapter Review	645
Programming Exercises	646

CHAPTER 15 Networking 649

Objectives	649
Introduction	650
Client/Server Computing	650
Serving Multiple Clients	656
Applet Clients	660
Viewing Web Pages	665
Retrieving Files from Web Servers	668
Chapter Summary	673
Chapter Review	673
Programming Exercises	674

APPENDIXES**677**

APPENDIX A	Java Keywords	679
APPENDIX B	The ASCII Character Set	681
APPENDIX C	Operator Precedence Chart	685
APPENDIX D	Java Modifiers	689
APPENDIX E	An HTML Tutorial	691
	Getting Started	692
	Structure Tags	694
	Text Appearance Tags	694
	Content-Based Tags	694
	Physical Tags	695
	Paragraph Style Tags	696
	Font, Size, and Color Tags	697
	List Tags	698
	Ordered Lists	699
	Unordered Lists	699
	Definition Lists	699
	Table Tags	700
	Hyperlink Tags	702
	Linking Documents on Different Computers	702
	Linking Documents on the Same Computer	703
	Jumping Within the Same Document	703
	Embedding Graphics	705
	Horizontal Bar Tags	705
	More on HTML	706
	Image Tags	706
APPENDIX F	Using the Companion CD-ROM and Installing the Swing Library	709
	Installing Visual J++ 6	709
	Installing Swing Library in Visual J++ 6	709
	Using the Examples in the Book	710
APPENDIX G	Rapid Java Application Development Using Visual J++ 6.0	713
	Form Designer Basics	714
	Switching between Form Designer and Code Editor	715
	The Toolbox Window	715
	The Properties Window	717
	Implementing Handlers	718
	Using the Form Designer to Develop Applications	720

Phase 1: Creating User Interface	721
Phase 2: Implementing Handlers	722
Phase 3: Creating Menus	723

APPENDIX H	Glossary	731
INDEX		739