

# Table of Contents

<b>Introduction</b> .....	<b>1</b>
About This Book.....	2
How to Use This Book .....	3
How This Book Is Organized.....	3
Book I: Java Basics .....	3
Book II: Programming Basics .....	3
Book III: Object-Oriented Programming .....	4
Book IV: Strings, Arrays, and Collections .....	4
Book V: Programming Techniques .....	4
Book VI: Swing .....	4
Book VII: Web Programming .....	4
Book VIII: Files and Databases .....	4
Book IX: Fun and Games .....	5
This book's Web site .....	5
Icons Used in This Book.....	5
Where to Go from Here.....	6
<b>Book I: Java Basics</b> .....	<b>7</b>
<b>Chapter 1: Welcome to Java</b> .....	<b>9</b>
What Is Java, and Why Is It So Great?.....	9
Platform independence .....	10
Object orientation .....	11
The Java API.....	12
The Internet.....	13
Comparing Java to Other Languages.....	13
Important Features of the Java Language .....	15
Type checking.....	15
Automatic memory management.....	17
Exception handling .....	17
On the Downside: Java's Weaknesses .....	18
Java Version Insanity .....	19
What's in a Name? .....	20
<b>Chapter 2: Installing and Using Java Tools</b> .....	<b>23</b>
Downloading and Installing the Java Development Kit.....	24
Downloading the JDK.....	24
Installing the JDK.....	24
Perusing the JDK folders .....	25
Setting the path .....	26

Using Java's Command-Line Tools .....	28
Compiling a program .....	28
Compiling more than one file.....	29
Using Java compiler options .....	30
Running a Java program .....	31
Using the javap command .....	33
Other Java command-line tools .....	35
Using Java Documentation.....	35
Java SE API Docs.....	36
Java Language Specification .....	37
<b>Chapter 3: Working with TextPad .....</b>	<b>39</b>
Downloading and Installing TextPad .....	39
Editing Source Files.....	40
Compiling a Program .....	42
Running a Java Program.....	44
Running an Applet.....	45
<b>Chapter 4: Using Eclipse .....</b>	<b>47</b>
Getting Some Perspective on Eclipse .....	48
Understanding Projects.....	50
Creating a Simple Project.....	51
Adding a Class File.....	56
Running a Program .....	59
Debugging a Java Program.....	61
Stepping through your programs.....	61
Examining variables .....	63
Setting breakpoints .....	64
Refactoring Your Code.....	65
<b><i>Book II: Programming Basics .....</i></b>	<b><i>67</i></b>
<b>Chapter 1: Java Programming Basics .....</b>	<b>69</b>
Looking at the Infamous Hello, World! Program .....	69
Dealing with Keywords.....	73
Working with Statements .....	75
Types of statements.....	75
White space.....	76
Working with Blocks .....	77
Creating Identifiers .....	78
Crafting Comments .....	78
End-of-line comments .....	79
Traditional comments.....	79
JavaDoc comments .....	80

Introducing Object-Oriented Programming .....	80
Understanding classes and objects .....	80
Understanding static methods .....	81
Creating an object from a class .....	82
A program that uses an object .....	82
So what's the difference? .....	84
Importing Java API Classes .....	86

**Chapter 2: Working with Variables and Data Types . . . . . 87**

Declaring Variables .....	87
Declaring two or more variables in one statement .....	88
Declaring class variables .....	89
Declaring instance variables .....	90
Declaring local variables .....	90
Initializing Variables .....	92
Initializing variables with assignment statements .....	92
Initializing variables with initializers .....	93
Using Final Variables (Constants) .....	94
Working with Primitive Data Types .....	94
Integer types .....	96
Floating-point types .....	97
The char type .....	98
The boolean type .....	99
Wrapper classes .....	100
Using Reference Types .....	100
Working with Strings .....	102
Declaring and initializing strings .....	102
Combining strings .....	103
Converting primitives to strings .....	104
Converting strings to primitives .....	104
Converting and Casting Numeric Data .....	105
Automatic conversions .....	105
Type casting .....	106
Thinking Inside the Box .....	107
Understanding Scope .....	107
Shadowing Variables .....	109
Printing Data with System.out .....	110
Standard input and output streams .....	110
Using System.out and System.err .....	111
Getting Input with the Scanner Class .....	112
Importing the Scanner class .....	113
Declaring and creating a Scanner object .....	113
Getting input .....	114
Getting Input with the JOptionPane Class .....	116

<b>Chapter 3: Working with Numbers and Expressions</b> .....	<b>119</b>
Working with Arithmetic Operators .....	119
Dividing Integers .....	122
Combining Operators .....	124
Using the Unary Plus and Minus Operators .....	125
Using Increment and Decrement Operators .....	126
Using the Assignment Operator .....	128
Using Compound Assignment Operators .....	129
Using the Math Class .....	130
Constants of the Math class .....	131
Mathematical functions .....	132
Creating random numbers .....	135
Rounding functions .....	138
Formatting Numbers .....	139
Weird Things about Java Math .....	142
Integer overflow .....	142
Floating-point weirdness .....	143
Dividing by zero .....	144
<b>Chapter 4: Making Choices</b> .....	<b>147</b>
Using Simple Boolean Expressions .....	147
Using if Statements .....	149
Simple if statements .....	150
if-else statements .....	152
Nested if statements .....	153
else-if statements .....	156
Mr. Spock's Favorite Operators (the Logical Ones, of Course) .....	158
Using the ! operator .....	159
Using the & and && operators .....	160
Using the   and    operators .....	161
Using the ^ operator .....	162
Combining logical operators .....	163
Using the Conditional Operator .....	164
Comparing Strings .....	165
<b>Chapter 5: Going Around in Circles (Or, Using Loops)</b> .....	<b>167</b>
Your Basic while Loop .....	168
The while statement .....	168
A counting loop .....	168
Breaking Out of a Loop .....	170
Looping Forever .....	170
Letting the user decide when to quit .....	172
Another way to let the user decide .....	173

Using the continue Statement .....	173
do-while Loops .....	175
Validating Input from the User .....	177
The Famous for Loop.....	179
The formal format of the for loop .....	180
Scoping out the counter variable .....	182
Counting even numbers .....	183
Counting backwards .....	184
for loops without bodies .....	185
Ganging up your expressions .....	186
Omitting expressions .....	187
Breaking and continuing your for loops .....	188
Nesting Your Loops.....	189
A simple nested for loop .....	189
A guessing game .....	190
<b>Chapter 6: Pulling a Switcheroo .....</b>	<b>.193</b>
else-if Monstrosities.....	193
A Better Version of the Voting Machine Error Decoder Program .....	195
Using the switch Statement .....	196
A Boring Business Example Complete with Flowchart .....	197
Putting if Statements Inside switch Statements .....	199
Creating Character Cases.....	200
Falling through the Cracks.....	201
<b>Chapter 7: Adding Some Methods to Your Madness .....</b>	<b>.205</b>
The Joy of Methods .....	205
The Basics of Making Methods.....	206
An example.....	207
Another example .....	208
Methods That Return Values .....	210
Declaring the method's return type.....	210
Using the return statement to return the value.....	211
Using a method that returns a type .....	212
You gotta have a proper return statement.....	212
Another version of the Guessing Game program .....	214
Using Methods That Take Parameters .....	217
Declaring parameters .....	217
Scoping out parameters .....	218
Understanding pass-by-value.....	219
Yet another example of the Guessing Game program .....	220

<b>Chapter 8: Handling Exceptions</b> .....	<b>223</b>
Understanding Exceptions.....	223
Witnessing an exception.....	225
Finding the culprit.....	225
Catching Exceptions .....	226
A simple example .....	227
Another example .....	228
Handling Exceptions with a Pre-emptive Strike .....	229
Catching All Exceptions at Once.....	231
Displaying the Exception Message .....	232
Using a finally Block.....	233
Handling Checked Exceptions.....	235
The catch-or-throw compiler error.....	235
Catching FileNotFoundException.....	236
Throwing the FileNotFoundException.....	237
Throwing an exception from main .....	238
Swallowing exceptions.....	238
Throwing Your Own Exceptions.....	239

***Book III: Object-Oriented Programming*** ..... **241**

<b>Chapter 1: Understanding Object-Oriented Programming</b> .....	<b>243</b>
What Is Object-Oriented Programming? .....	243
Understanding Objects.....	244
Objects have identity.....	245
Objects have type.....	246
Objects have state.....	246
Objects have behavior.....	247
The Life Cycle of an Object .....	248
Working with Related Classes.....	249
Inheritance .....	249
Interfaces .....	250
Designing a Program with Objects.....	250
Diagramming Classes with UML.....	251
Drawing classes .....	252
Drawing arrows.....	254
<b>Chapter 2: Making Your Own Classes</b> .....	<b>255</b>
Declaring a Class .....	255
Picking class names .....	256
What goes in the class body .....	256
Where classes go .....	257

Working with Members .....	259
Fields .....	259
Methods .....	259
Understanding visibility .....	260
Getters and Setters .....	260
Overloading Methods .....	263
Creating Constructors .....	264
Basic constructors .....	264
Default constructors .....	265
Calling other constructors .....	266
More Uses for this .....	268
Using Initializers .....	269

**Chapter 3: Working with Statics . . . . . 271**

Understanding Static Fields and Methods .....	271
Working with Static Fields .....	272
Using Static Methods .....	273
Counting Instances .....	274
Preventing Instances .....	277
Using Static Initializers .....	278

**Chapter 4: Using Subclasses and Inheritance . . . . . 279**

Introducing Inheritance .....	279
Motorcycles, trains, and automobiles .....	280
Playing games .....	281
A businesslike example .....	281
Inheritance hierarchies .....	282
Creating Subclasses .....	282
Overriding Methods .....	284
Protecting Your Members .....	285
Using this and super in Your Subclasses .....	286
Inheritance and Constructors .....	287
Using final .....	288
Final methods .....	289
Final classes .....	289
Casting Up and Down .....	290
Determining an Object's Type .....	291
Poly What? .....	292
Creating Custom Exceptions .....	295
The Throwable hierarchy .....	295
Creating an exception class .....	296
Throwing a custom exception .....	297

<b>Chapter 5: Using Abstract Classes and Interfaces</b> .....	<b>299</b>
Using Abstract Classes .....	299
Using Interfaces .....	302
Creating a basic interface .....	302
Implementing an interface .....	303
Using an interface as a type .....	304
More Things You Can Do with Interfaces .....	305
Adding fields to an interface .....	305
Extending interfaces .....	305
Using interfaces for callbacks .....	307
<b>Chapter 6: Using the Object and Class Classes</b> .....	<b>311</b>
The Mother of All Classes: Object .....	311
Every object is an Object .....	311
Using Object as a type .....	312
Methods of the Object class .....	313
Primitives aren't objects .....	314
The toString Method .....	315
Using toString .....	315
Overriding toString .....	316
The equals Method .....	317
Using equals .....	318
Overriding the equals method .....	319
The clone Method .....	323
Implementing the clone method .....	323
Using clone to create a shallow copy .....	326
Creating deep copies .....	327
The Class Class .....	333
<b>Chapter 7: Using Inner Classes</b> .....	<b>335</b>
Declaring Inner Classes .....	335
Understanding inner classes .....	336
An example .....	336
Using Static Inner Classes .....	339
Using Anonymous Inner Classes .....	341
Creating an anonymous class .....	341
Tick Tock with an anonymous class .....	342
<b>Chapter 8: Packaging and Documenting Your Classes</b> .....	<b>345</b>
Working with Packages .....	345
Importing classes and packages .....	346
Creating your own packages .....	347
An example .....	348
Putting Your Classes in a JAR File .....	350
jar command-line options .....	350
Archiving a package .....	351
Adding a jar to your classpath .....	352
Running a program directly from an archive .....	353

Using JavaDoc to Document Your Classes .....	354
Adding JavaDoc comments .....	354
Using the javadoc command .....	357
Viewing JavaDoc pages .....	357

## ***Book IV: Strings, Arrays, and Collections* .....359**

### **Chapter 1: Working with Strings .....361**

Reviewing Strings .....	361
Using the String Class .....	363
Finding the length of a string .....	365
Making simple string modifications .....	366
Extracting characters from a string .....	366
Extracting substrings from a string .....	367
Splitting up a string .....	369
Replacing parts of a string .....	371
Using the StringBuilder and StringBuffer Classes .....	371
Creating a StringBuilder object .....	372
Using StringBuilder methods .....	373
A StringBuilder example .....	375
Using the CharSequence Interface .....	375

### **Chapter 2: Using Arrays .....377**

Understanding Arrays .....	377
Creating Arrays .....	378
Initializing an Array .....	379
Using for Loops with Arrays .....	380
Solving Homework Problems with Arrays .....	381
Using the Enhanced for Loop .....	383
Using Arrays with Methods .....	384
Using Two-Dimensional Arrays .....	385
Creating a two-dimensional array .....	386
Accessing two-dimensional array elements .....	387
Initializing a two-dimensional array .....	388
Using jagged arrays .....	388
Going beyond two dimensions .....	390
A Fun but Complicated Example: A Chessboard .....	391
Using the Arrays Class .....	398
Filling an array .....	399
Copying an array .....	400
Sorting an array .....	401
Searching an array .....	401
Comparing arrays .....	402
Converting arrays to strings .....	402

<b>Chapter 3: Using the ArrayList Class</b> .....	<b>405</b>
The ArrayList Class.....	406
Creating an ArrayList Object.....	408
Adding Elements .....	409
Accessing Elements .....	410
Printing an ArrayList .....	411
Using an Iterator.....	412
Updating Elements.....	413
Deleting Elements .....	415
<b>Chapter 4: Using the LinkedList Class</b> .....	<b>417</b>
The LinkedList Class.....	417
Creating a LinkedList.....	422
Adding Items to a LinkedList.....	422
Retrieving Items from a LinkedList.....	424
Updating LinkedList Items .....	426
Removing LinkedList Items.....	426
<b>Chapter 5: Creating Generic Collection Classes</b> .....	<b>429</b>
Why Generics?.....	430
Creating a Generic Class .....	431
A Generic Stack Class .....	432
Using Wildcard-Type Parameters.....	436
A Generic Queue Class .....	437

## ***Book V: Programming Techniques***.....**441**

<b>Chapter 1: Programming Threads</b> .....	<b>443</b>
Understanding Threads.....	443
Creating a Thread.....	444
Understanding the Thread class .....	445
Extending the Thread class.....	446
Creating and starting a thread.....	447
Implementing the Runnable Interface .....	448
Using the Runnable interface.....	448
Creating a class that implements Runnable.....	449
Using the CountdownApp class .....	450
Creating Threads That Work Together.....	452
Using an Executor .....	456
Synchronizing Methods.....	458
Creating a Lock.....	462
Threadus Interruptus .....	463
Finding out whether you've been interrupted.....	464
Aborting the countdown .....	465

<b>Chapter 2: Network Programming</b> .....	<b>471</b>
Understanding Network Programming.....	471
IP addresses and ports .....	472
Host names, DNS, and URLs.....	473
Telnet .....	473
Getting Information about Internet Hosts.....	474
The InetAddress class.....	474
A program that looks up host names .....	475
Creating Network Server Applications.....	478
The Socket class .....	479
The ServerSocket class.....	480
Introducing BART .....	481
The BartQuote class .....	482
The BartServer program .....	483
The BartClient program.....	487
BartServer 2.0 .....	490
 <b>Chapter 3: Using Regular Expressions</b> .....	 <b>495</b>
A Program for Experimenting with Regular Expressions.....	496
Basic Character Matching.....	498
Matching single characters.....	499
Using predefined character classes.....	499
Using custom character classes.....	501
Using ranges.....	502
Using negation .....	503
Matching multiple characters.....	503
Using escapes .....	505
Using parentheses to group characters .....	505
Using the   symbol.....	506
Using Regular Expressions in Java Programs.....	507
The String problem .....	507
Using regular expressions with the String class.....	508
Using the Pattern and Matcher classes .....	509
 <b>Chapter 4: Using Recursion</b> .....	 <b>511</b>
The Classic Factorial Example.....	511
The non-recursive solution.....	511
The recursive solution.....	512
Displaying Directories .....	514
Writing Your Own Sorting Routine.....	517
Understanding how Quicksort works .....	518
The sort method.....	519
The partition method.....	520
Putting it all together .....	521

<b>Book VI: Swing</b> .....	<b>525</b>
<b>Chapter 1: Swinging into Swing</b> .....	<b>527</b>
Some Important Swing Concepts You Need to Know .....	527
Understanding what Swing does .....	527
The Swing class hierarchy.....	528
I've Been Framed!.....	530
Hello, World! in Swing.....	531
Positioning the Frame On-Screen.....	534
Using the JPanel Class .....	535
Using Labels.....	536
Creating Buttons .....	538
A Word about the Layout of Components.....	540
<b>Chapter 2: Handling Events</b> .....	<b>541</b>
Examining Events .....	541
Handling Events.....	544
The ClickMe Program .....	546
Using Inner Classes to Listen for Events.....	548
Adding an Exit Button.....	550
Catching the WindowClosing Event.....	552
The ClickMe Program Revisited .....	554
<b>Chapter 3: Getting Input from the User</b> .....	<b>557</b>
Using Text Fields .....	557
Looking at a sample program .....	559
Using text fields for numeric entry .....	562
Creating a validation class .....	563
Using Text Areas.....	565
The JTextArea class .....	566
The JScrollPane class.....	568
Using Check Boxes.....	569
Using Radio Buttons .....	572
Using Borders .....	574
Designing a Pizza-Ordering Program .....	577
Using Sliders .....	581
<b>Chapter 4: Choosing from a List</b> .....	<b>585</b>
Using Combo Boxes .....	585
Creating combo boxes .....	587
Getting items from a combo box.....	588
Handling combo box events .....	589
Using Lists.....	590
Creating a list .....	592
Getting items from a list .....	592
Changing list items.....	594

Using Spinners .....	595
Using Trees .....	597
Building a tree .....	598
Creating a JTree component .....	601
Getting the selected node .....	603
Putting it all together .....	604

**Chapter 5: Using Layout Managers** ..... **607**

Introducing Layout Managers .....	607
Using Flow Layout .....	609
Using Border Layout .....	611
Using Box Layout .....	612
Using Grid Layout .....	614
Using GridBag Layout .....	616
Sketching out a plan .....	616
Adding components to a GridBag .....	618
Working with GridBagConstraints .....	619
A GridBag layout example .....	621
Using Group Layout .....	624

***Book VII: Web Programming*** ..... **629**

**Chapter 1: Creating Applets** ..... **631**

Understanding Applets .....	631
The JApplet Class .....	632
Looking at a Sample Applet .....	633
Creating an HTML Page for an Applet .....	637
Testing an Applet .....	637

**Chapter 2: Creating Servlets** ..... **639**

Understanding Servlets .....	639
Using Tomcat .....	640
Installing and configuring Tomcat .....	641
Starting and stopping Tomcat .....	643
Testing Tomcat .....	644
Creating a Simple Servlet .....	645
Importing the servlet packages .....	645
Extending the HttpServlet class .....	645
Printing to a Web page .....	646
Responding with HTML .....	646
Running a Servlet .....	649
An Improved HelloWorld Servlet .....	649
Getting Input from the User .....	651
Working with forms .....	651
The InputServlet servlet .....	652
Using Classes in a Servlet .....	654

<b>Chapter 3: Using Java Server Pages</b> .....	<b>659</b>
Understanding Java Server Pages .....	659
Using Page Directives .....	661
Using Expressions .....	662
Using Scriptlets .....	664
Using Declarations .....	666
Using Classes .....	668
<b>Chapter 4: Using JavaBeans</b> .....	<b>673</b>
What Is a JavaBean? .....	673
Looking Over a Sample Bean .....	674
Using Beans with JSP Pages .....	677
Creating bean instances .....	677
Getting property values .....	678
Setting property values .....	679
A JSP page that uses a bean .....	680
Scoping Your Beans .....	682
A shopping cart application .....	682
The shopping cart page .....	684
The BookCart JavaBean .....	685

***Book VIII: Files and Databases***..... **689**

<b>Chapter 1: Working with Files</b> .....	<b>691</b>
Using the File Class .....	691
Creating a File object .....	693
Creating a file .....	694
Getting information about a file .....	694
Getting the contents of a directory .....	695
Renaming files .....	696
Deleting a file .....	696
Using Command-Line Parameters .....	697
Choosing Files in a Swing Application .....	698
Creating an Open dialog box .....	700
Getting the selected file .....	701
Using file filters .....	702
<b>Chapter 2: Using File Streams</b> .....	<b>705</b>
Understanding Streams .....	705
Reading Character Streams .....	706
Creating a BufferedReader .....	708
Reading from a character stream .....	708
Reading the movies.txt file .....	709

Writing Character Streams .....	712
Connecting a PrintWriter to a text file .....	713
Writing to a character stream .....	715
Writing the movies.txt file .....	715
Reading Binary Streams .....	718
Creating a DataInputStream .....	719
Reading from a data input stream .....	720
Reading the movies.dat file .....	721
Writing Binary Streams.....	724
Creating a DataOutputStream .....	726
Writing to a binary stream .....	726
Writing the movies.dat file .....	727

**Chapter 3: Database for \$100, Please . . . . . 731**

What Is a Relational Database? .....	731
What Is SQL, and How Do You Pronounce It?.....	732
SQL Statements .....	732
Creating a SQL Database .....	733
Querying a Database.....	736
Using your basic select.....	736
Narrowing down the query .....	737
Excluding rows.....	738
Singleton selects .....	738
Sounds like .....	738
Column functions .....	739
Selecting from more than one table.....	740
Eliminating duplicates .....	741
Updating and Deleting Rows.....	742
The delete statement .....	742
The update statement.....	744

**Chapter 4: Using JDBC to Connect to a Database . . . . . 747**

Setting Up a Driver .....	747
Setting up an ODBC data source .....	747
Setting up the MySQL JDBC connector .....	749
Connecting to a Database .....	750
Querying a Database.....	751
Executing a select statement .....	752
Navigating through the result set.....	753
Getting data from a result set .....	753
Putting it all together: A program that reads from a database .....	755
Updating SQL Data.....	758
Using an Updatable RowSet Object .....	759
Deleting a row .....	761
Updating the value of a row column .....	761
Inserting a row .....	762

<b>Chapter 5: Working with XML</b> .....	<b>763</b>
What Exactly Is XML, Anyway?.....	763
Tags .....	764
Attributes .....	765
The movies.xml file .....	766
Using a DTD .....	767
Processing XML in Two Ways .....	769
Reading a DOM Document .....	771
Creating a document builder factory.....	771
Configuring the document builder factory .....	772
Creating a document builder and the document .....	772
Using the getDocument method.....	773
Reading DOM Nodes .....	774
Processing elements .....	775
Getting attribute values .....	776
Getting child element values .....	777
Putting It All Together: A Program That Lists Movies.....	778

***Book IX: Fun and Games*** .....

<b>Chapter 1: Fun with Fonts and Colors</b> .....	<b>785</b>
Working with Fonts .....	785
Using font names .....	786
Using font styles .....	786
Setting a component's font .....	787
Getting a list of all available fonts .....	788
A program that plays with fonts.....	788
Working with Color .....	792
Creating colors.....	792
Using system colors .....	793
Setting the color of Swing components.....	795
Using a color chooser .....	795
<b>Chapter 2: Drawing Shapes</b> .....	<b>799</b>
Getting a Graphics Context.....	799
Drawing Shapes .....	800
Creating Shapes.....	803
Creating lines .....	804
Creating rectangles .....	805
Creating ellipses .....	806
Creating arcs .....	806
Looking at the ShapeMaker program.....	807

Filling Shapes .....	809
Drawing transparently .....	809
Using a gradient fill .....	810
Rotating and Translating .....	812
Translate method .....	812
Rotate method .....	812
Drawing Text .....	814
Letting the User Draw on a Component .....	814

**Chapter 3: Using Images and Sound** ..... **821**

Using Images .....	822
Using the ImageIcon Class .....	822
Using ImageIcon in a Swing application .....	823
Using ImageIcon in an applet .....	825
Using the Image Class .....	825
Creating an Image object .....	826
Drawing an Image object .....	827
An Image example .....	828
Playing Sounds and Making Music .....	831

**Chapter 4: Animation and Game Programming** ..... **833**

Animating a Sprite .....	833
What about Double Buffering? .....	837
Bouncing the Ball .....	837
Bouncing a Bunch of Balls .....	839
Creating a Ball class .....	839
Animating random balls .....	841
Creating Collidable Balls .....	842
Playing Games .....	844

***Index*** ..... **851**

