

SHELLY CASHMAN SERIES®

Java Programming

Comprehensive Concepts and Techniques

THIRD EDITION

Shelly
Cashman
Starks
Mick





Java Programming Comprehensive Concepts and Techniques Third Edition

Gary B. Shelly
Thomas J. Cashman
Joy L. Starks
Michael L. Mick

THOMSON COURSE TECHNOLOGY
25 THOMSON PLACE
BOSTON MA 02210

 **SHELLY
CASHMAN
SERIES.**

Australia • Canada • Denmark • Japan • Mexico • New Zealand • Philippines • Puerto Rico • Singapore
South Africa • Spain • United Kingdom • United States

This is an electronic version of the print textbook. Due to electronic rights restrictions, some third party content may be suppressed. Editorial review has deemed that any suppressed content does not materially affect the overall learning experience. The publisher reserves the right to remove content from this title at any time if subsequent rights restrictions require it. For valuable information on pricing, previous editions, changes to current editions, and alternate formats, please visit www.cengage.com/highered to search by ISBN#, author, title, or keyword for materials in your areas of interest.

Java Programming
Comprehensive Concepts and Techniques, Third Edition
Gary B. Shelly
Thomas J. Cashman
Joy L. Starks
Michael L. Mick

Managing Editor:

Alexandra Arnold

Series Consulting Editor:

Jim Quasney

Marketing Manager:

Dana Merk

Senior Product Manager:

Karen Stevens

Product Manager:

Reed Cotter

Associate Product Manager:

Selena Coppock

Editorial Assistant:

Patrick Frank

Print Buyer:

Justin Palmeiro

Production Editor:

Marissa Falco

Marketing Coordinator:

Melissa Marcoux

Quality Assurance:

Burt LaFountain

Danielle Shaw

Copy Editor:

Lyn Markowicz

Proofreader:

John Bosco

Cover Art:

John Still

Compositors:

Jeanne Black

Pre-Press Company, Inc.

Printer:

Banta Company

COPYRIGHT © 2006 Thomson Course Technology, a division of Thomson Learning, Inc. Thomson Learning™ is a trademark used herein under license.

Printed in the United States of America

1 2 3 4 5 6 7 8 9 10 BM 09 08 07 06 05

For more information, contact Thomson Course Technology
25 Thomson Place
Boston, Massachusetts 02210

Or find us on the World Wide Web at: www.course.com

ALL RIGHTS RESERVED. No part of this work covered by the copyright hereon may be reproduced or used in any form or by any means — graphic, electronic, or mechanical, including photocopying, recording, taping, Web distribution, or information storage and retrieval systems — without the written permission of the publisher.

For permission to use material from this text or product, submit a request online at www.thomsonrights.com

Any additional questions about permissions can be submitted by e-mail to thomsonrights@thomson.com

Thomson Course Technology, the Course Technology logo, the Shelly Cashman Series® and Customer Edition® are registered trademarks used under license. All other names used herein are for identification purposes only and are trademarks of their respective owners.

Disclaimer: Thomson Course Technology reserves the right to revise this publication and make changes from time to time in its content without notice.

ISBN-13: 978-1-4188-5985-5

ISBN-10: 1-4188-5985-0

Java Programming Comprehensive Concepts and Techniques Third Edition

C o n t e n t s

Preface	xiii	Object-Oriented Programming (OOP)	
To the Student	xx	Concepts	26
		Object-Oriented Case Scenario	26
		Encapsulation, Inheritance, and	
		Polymorphism	26
		Encapsulation	27
		Inheritance	27
		Polymorphism	28
		Rapid Application Development (RAD)	29
		What Is the Java SDK?	29
		The Java Compiler	30
		The Java Virtual Machine	30
		The Java API	30
		The Java Applet Viewer	32
		Other Java Development Tools	32
		Short Answer	35
		Learn It Online	37
		1 Using Object Terminology	37
		2 Writing Pseudocode	38
		3 Analyzing Requirements	39
		4 Understanding Flowcharts	40
		5 Understanding Event Diagrams	42
		6 Creating a Generalization Hierarchy	42
		7 Creating Class Diagrams	42
		8 Creating an Event Diagram	42
		9 Thinking Algorithmically	43
		10 Identifying Triggers and Events	43
		11 Understanding Java Components	43
		12 Exploring Other Java Technologies	44
		13 Blog about Java Technology	44
<hr/>			
CHAPTER 1			
An Introduction to Java and Program Design			
Objectives	1		
Introduction	2		
What Is Java?	2		
Characteristics of Java	3		
The Java Software Development Kit (SDK)	3		
Java Program Types	3		
Console and Windowed Applications	5		
Applets	6		
Servlets	7		
Web Services	8		
JavaBeans	9		
Programming a Computer	10		
The Program Development Cycle	11		
Analyze the Requirements — Phase 1	14		
Design the Solution — Phase 2	15		
Validate the Design — Phase 3	19		
Implement the Design — Phase 4	20		
Test the Solution — Phase 5	21		
Document the Solution — Phase 6	22		
Object-Oriented Programming and Design	22		
Object-Speak	22		

CHAPTER 2

Creating a Java Application and Applet

Objectives	45
Introduction	46
Chapter Two — The Welcome to My Day Program	46
Program Development	47
Analysis and Design	48
Using TextPad	52
Starting TextPad	52
The TextPad Window	54
Displaying Line Numbers in the TextPad Window	55
Saving a TextPad Document	56
Coding the Program	61
Coding Comments as Documentation	61
The Class Header	64
The Method Header	67
Coding Output	70
Testing the Solution	73
Compiling the Source Code	73
Debugging the Solution	74
System Errors	74
Syntax Errors	75
Semantic Errors	76
Logic and Run-Time Errors	77
Running the Application	77
Running the Application	77
Editing the Source Code	79
Entering Code to Import Packages	80
Entering Code to Call a System Date Constructor	82
Formatting Output Using Escape Characters	84
Recompiling and Running the Application	86
Printing the Source Code	87
Quitting TextPad	88
Moving to the Web	89
Opening an Existing File in TextPad	89
Entering Code to Import Applet Packages	92
Changing the Class Name and Extending the Applet Class	93
The paint() Method	95
The drawString() Method	96
Entering Code to Draw an Image and Set the Background Color	98

Saving a Source Code File with a New Name	100
Compiling the Applet	101
Creating an HTMLHost Document	101
Coding an HTML Host Document	101
Running an Applet	104
Documenting the Applet and HTML Host Document	106
Quitting TextPad	110
Label the Figure	113
Identify Code	114
Understanding Error Messages	115
Using the Java API	116
Short Answer	117
Learn It Online	118
1 Writing Java Code from a Flowchart	120
2 Analysis and Design	121
3 Coding Your Own Splash Screen	122
4 Converting an Application to an Applet	123
5 Formatting Output Using Escape Characters	123
6 Creating an Applet with a Background Color	124
7 Rick's Riding Rodeo	125
8 Accessing the System Date	125
9 Looking at Applets	125
10 Your School Logo	126
11 Creating a Splash Screen	126
12 Creating New Colors	126

CHAPTER 3

Manipulating Data Using Methods

Objectives	127
Introduction	128
Chapter Three — The Body Mass Index Calculator	128
Program Development	130
Analysis and Design	130
Starting a New Java Program in Textpad	136
Coding the Program	137
Entering Beginning Code	137
Storing Data	139
Java Data Types	139
Declaring Variables	141
User Input	143
Streams and the System Class	143
The BufferedReader Class	144

User Prompts, Inputs, and Conversions	147	Short Answer	201
Assignment Statements	148	Learn It Online	204
Operators	150	1 Writing Java Code from Pseudocode	206
Arithmetic Operators	151	2 Analysis and Design	207
Comparison Operators	153	3 Converting from Sample Data to User Input	208
Expressions	154	4 Interactive Checkbook Balancing Calculator	209
Numeric Expressions	154	5 Income to Debt Ratio Calculator	210
Forming Valid Numeric Expressions	154	6 Creating an Applet	212
Evaluation of Numeric Expressions	155	7 Bill's Burgers	214
Conditional Expressions	156	8 Ohm's I Law	215
Using Parentheses in Expressions	157	9 Calculating the Circumference of a Circle	215
Construction of Error-Free Expressions	158	10 Dollars and Cents	215
The Math Class	159	11 Currency Conversion	215
Program Output	161	12 Using the Sun Microsystems Java Documentation	215
Using Variables in Output	161	13 Moving from the BufferedReader to Scanner	216
Compiling, Running, and Documenting the Application	163	14 Moving from Swing to Scanner	216
Compiling the Source Code	163	15 Input Usability	216
Running and Testing the Application	164	16 The Scanner Methods	216
Printing the Source Code	166		
Using Swing Components	166		
Editing the File Name	166		
Importing Classes from the javax.swing Package	168		
Deleting Existing Code	169		
Creating Swing Dialog Boxes	170		
Closing Programs That Use Swing	173		
Saving, Compiling, and Running the Swing Version	175		
Saving and Compiling the Swing Version	175		
Running and Testing the Swing Program	175		
Moving to the Web	178		
Implementing an ActionListener to Handle Events	178		
Adding Interface Components to an Applet	181		
Programming Conventions	182		
The init() Method	184		
The actionPerformed() Method	187		
The paint() Method	189		
Compiling the Applet	191		
Creating an HTML Host Document for an Interactive Applet	191		
Creating the Host Document	191		
Running and Testing an Interactive Applet	192		
File Management	194		
1 Label the Figure	198		
2 Identify Code	198		
3 Understanding Error Messages	200		
4 Using the Java API	200		

CHAPTER 4

Decision Making and Repetition with Reusable Objects

Objectives	217
Introduction	218
Program Development	219
Analysis and Design	220
Starting a New Java Program in TextPad	223
Coding the Program	224
Entering Beginning Code	225
Compiling and Testing the Program Stub	227
Writing Methods	227
Calling a Method	228
Coding a Method	229
Testing the getSales() Method	232
The if...else Statement	233
Using Operators in an if...else Statement	235
Coding an if Statement to Test the Cancel Button	236
Coding an if Statement to Test Multiple Conditions	239

Exception Handling	239	5 Freddie's Fast Food	300
Handling Exceptions Using try and catch Statements	240	6 Traffic Violations	301
Catching a NumberFormatException in the getSales() Method	242	7 We Love Pets	302
Throwing an Exception	244	8 Reasonable Computers Corporation	302
Repetition Structure	247	9 Wright's Garage	302
The while Statement	247	10 Overdue Books	302
Testing the while Statement	250	11 Stockbroker's Commission	303
The getCode() Method	250	12 Volume Computations	303
Testing the getCode() Method	253	13 What's My Color	304
The Case Structure	253	14 Formatting Output	304
The switch Statement	254	15 Using the API	304
The getComm() Method	255	16 Using the printf() Method	304
Formatting Numeric Output	257		
Coding the output() Method	258		
The finish() Method	260		
Moving to the Web	262		
Creating the Host Document	262		
Coding an Applet Stub	263		
Declaring Variables and Constructing Colors	266		
Making Decisions in Applets	267		
Constructing Checkboxes	268		
Constructing Applet Components	269		
Adding Color, Components, Focus, and Listeners to the Applet	270		
Coding the init() Method	272		
Compiling and Testing the init() Method	273		
Handling Exceptions in the Applet Using try and catch Statements	275		
Coding the getSales() Method for the Applet	277		
Coding the getCode() Method for the Applet	278		
Coding the getComm() Method for the Applet	279		
Coding the output() Method for the Applet	281		
Coding the paint() Method	282		
Compiling and Testing the Applet	283		
Label the Figure	289		
Identify Code	289		
Understanding Error Messages	291		
Short Answer	291		
Learn It Online	294		
1 Multiplication Quiz	295		
2 Using switch and try Statements to Validate User Input	296		
3 Writing User-Defined Methods	298		
4 User Decisions	299		

CHAPTER 5

Arrays, Loops, and Layout Managers Using External Classes

Objectives	305
Introduction	306
Chapter Five - Reservations	306
Program Development	307
Analysis and Design	307
Starting a New Java Program In TextPad	316
Creating an External Class	317
The Rooms Class	317
Arrays	318
Declaring and Constructing an Array	319
Two-Dimensional Arrays	321
Declaring Variables in the Rooms Class	321
Constructing an Instance	322
The Rooms() Constructor Method	323
Counter-Controlled Loops	324
The for Statement	325
Assignment and Unary Operators	326
Using Unary Operators in for Loops	329
Exiting a for Loop Prematurely	331
Nested Loops	331
Instance Methods	332
The bookRoom() Method	332
Compiling the Rooms Class Source Code	335
Creating Windowed Applications	335
Using Frames in a Windowed Application	336