Table of Contents

Introduction ..... **xv**

Chapter 1: Introduction to Java **1**

1.1 Introducing Object-Oriented Programming 2
1.1.1 Explaining OOP Concepts 2
1.2 Evolution of Java 5
1.2.1 Introducing Java 5
1.3 Comparing Java with C++ 6
1.4 Features of Java 8
1.4.1 Simple 8
1.4.2 Secure 8
1.4.3 Portable 8
1.4.4 Robust 9
1.4.5 Multithreaded 9
1.4.6 Platform Independent 9
1.4.7 Distributed 10
1.4.8 Dynamic 10
1.5 Exploring New Features of Java SE 8.0 10
1.6 Introducing the Java Environment 11
1.6.1 Explaining Java Development Kit (JDK) 12
1.6.2 Explaining Java Platform Components 12
1.6.3 Types of Java Programs 14
1.7 Developing a Simple Java Program 15
1.7.1 Writing the Java Program 15
1.7.2 Saving the Java Program 17
1.7.3 Compiling the Java Program 18
1.7.4 Executing the Java Program 19
Summary 20
Key Terms 20
Review Exercise 20
True or False 20
Multiple Choice Questions 21
Descriptive Questions 22

Chapter 2: Fundamental Concepts in Java Programming **25**

2.1 Working with Java Tokens 25
2.1.1 Using Keywords 26

2.1.2 Using Identifiers 26
2.1.3 Using Literals 27
2.1.4 Using Constants 29
2.1.5 Using Separators 30
2.1.6 Using Operators 30
2.2 Operator Precedence and Associativity 38
2.3 Declaring Variables 39
2.4 Introducing Data Types 40
2.4.1 Integer Data Types 40
2.4.2 Floating-point Data Types 41
2.4.3 Character Data Type 42
2.4.4 The Boolean Data Type 42
2.5 Control Statements 43
2.5.1 Using Selection Statements 43
2.5.2 Using Iteration Statements 49
2.5.3 Using Jump Statements 53
Summary 56
Key Terms 56
Review Exercise 56
True or False 56
Multiple Choice Questions 57
Descriptive Questions 58

Chapter 3: Working with Arrays, Strings, StringBuffer Class, and Wrapper Classes..... 61

3.1 Working with Arrays 62
3.1.1 Using One-dimensional Array 62
3.1.2 Using Multidimensional Array 66
3.2 Working with Strings 69
3.2.1 Defining the String Class 70
3.2.2 Operations on String 70
3.2.3 Using Methods of the String Class 71
3.2.4 Comparing the equals() Method and == Operator 75
3.3 Using the StringBuffer Class 76
3.4 Using Command Line Arguments 77
3.5 Using the Wrapper Classes 78
Summary 79
Key Terms 79
Review Exercise 79
True or False 79

Multiple Choice Questions 80
Descriptive Questions 81

Chapter 4: Working with Classes, Objects, and Methods 85

4.1 Working with Classes 86
4.1.1 Declaring and Using Classes 86
4.1.2 Access Control and Modifiers 87
4.2 Working with Objects 88
4.2.1 The this Keyword 89
4.2.2 The finalize() Method 89
4.3 Explaining Constructors 90
4.3.1 Defining Simple Constructors 90
4.3.2 Defining Parameterized Constructors 91
4.3.3 Overloading Constructors 93
4.4 Declaring Methods 94
4.4.1 Methods Returning a Value 95
4.4.2 Passing Arguments to Methods 95
4.4.3 Method Overloading 98
4.5 Recursion in Java 99
4.6 Working with Abstract Class 100
4.7 Working with Nested Classes 101
4.8 Working with the Inner Class 102
4.9 Working with the Anonymous Inner Class 103
Summary 103
Key Terms 103
Review Exercise 104
True or False 104
Multiple Choice Questions 105
Descriptive Questions 106

Chapter 5: Inheritance and Interfaces in Java 111

5.1 Understanding Inheritance 111
5.1.1 Inheriting Data Members and Methods 112
5.2 Constructors in Inheritance 113
5.3 Multilevel Inheritance 114
5.3.1 Method Overriding 116
5.3.2 Handling Multilevel Constructors 117
5.3.3 Using the super Keyword 118
5.4 Using the final Keyword 119

5.5 Working with Interfaces in Java 121
5.5.1 Creating Interfaces 121
5.5.2 Implementing Interfaces 122
5.5.3 Using Reference Variables of an Interface 123
5.5.4 Inheriting Interfaces 124
5.5.5 Accessing Interface Variables 124
5.5.6 Comparison between Abstract Class and Interface 125
5.6 Understanding Dynamic Method Dispatch 126
5.7 Understanding the Java Object Class 128
Summary 128
Key Terms 128
Review Exercise 129
True or False 129
Multiple Choice Questions 129
Descriptive Questions 131

Chapter 6: Working with Packages and Exceptions 137

6.1 Understanding Packages in Java 137
6.1.1 Creating a Package 138
6.1.2 Importing Packages 140
6.1.3 Demonstrating Access Protection 141
6.1.4 Static Import 144
6.1.5 Classpath 145
6.2 JAR Files 147
6.2.1 Creating a JAR File 148
6.3 Defining Java API Packages 149
6.3.1 The java.lang Package 150
6.3.2 The java.util Package 151
6.4 Handling Exceptions 152
6.4.1 Understanding Exception and Error 153
6.4.2 Exception Handling 157
6.4.3 Handling Multiple Exceptions 165
6.4.4 Types of Exceptions 166
Summary 169
Key Terms 170
Review Exercise 170
True or False 170
Multiple Choice Questions 171
Descriptive Questions 172

Chapter 7: Working with Thread..... 175
7.1 An Overview of Threads..... 175
7.2 Defining a Thread..... 176
7.2.1 The Main Thread..... 177
7.2.2 Extending the Thread Class..... 177
7.2.3 Implementing the Runnable Interface..... 178
7.3 Instantiating a Thread..... 179
7.4 Starting a Thread..... 180
7.4.1 Starting and Running Multiple Threads..... 181
7.5 Thread States and Transitions..... 183
7.5.1 Thread States..... 183
7.5.2 Thread Priorities..... 184
7.5.3 Thread Scheduler..... 186
7.5.4 Running and Yielding..... 186
7.5.5 Sleeping and Waking Up..... 187
7.5.6 Joining..... 189
7.5.7 Blocking for I/O..... 191
7.5.8 Thread Termination..... 192
7.5.9 Deadlocks..... 192
7.6 Code Synchronization..... 192
7.6.1 Locks..... 193
7.6.2 Synchronized Methods..... 194
7.6.3 Synchronized Blocks..... 197
7.7 Thread Interaction..... 198
Summary..... 201
Key Terms..... 201
Review Exercise..... 202
True or False..... 202
Multiple Choice Questions..... 202
Descriptive Questions..... 204

Chapter 8: Working with Streams..... 209
8.1 Introduction to Stream..... 209
8.2 Introduction to NIO..... 210
8.2.1 Essentials in NIO..... 210
8.2.2 Buffers..... 211
8.2.3 Channels..... 212
8.2.4 Charsets and Selectors..... 213

8.2.5 Enhancements in NIO with Java 8 214
8.3 Working with Stream Classes 214
8.3.1 The InputStream Class 214
8.3.2 The OutputStream Class 215
8.3.3 The Reader Class 216
8.3.4 The Writer Class 217
8.3.5 The InputStreamReader Class 217
8.3.6 The OutputStreamWriter Class 219
8.3.7 The ByteArrayInputStream Class 220
8.3.8 The ByteArrayOutputStream Class 221
8.4 Working with Files 223
8.4.1 Using the File Class 223
8.4.2 Using the FileReader Class 226
8.4.3 Using the FileWriter Class 226
8.4.4 The FileInputStream Class 228
8.4.5 The FileOutputStream Class 229
8.5 Working with Buffers 231
8.5.1 Using the BufferedReader Class 231
8.5.2 Using the BufferedWriter Class 233
8.6 Working with Character Arrays 233
8.6.1 Using the CharArrayReader Class 234
8.6.2 Using the CharArrayWriter Class 235
8.7 Working with the PrintWriter Class 237
8.8 Working with the StreamTokenizer Class 239
8.9 Implementing the Serializable Interface 241
8.10 Working with the Console Class 244
8.11 Printing with the Formatter Class 246
8.11.1 Using the System.out.printf() Method 246
8.11.2 Using the String.format() Method 247
8.11.3 Formatting Dates Using the String.format() Method 248
8.11.4 Using the java.util.Formatter Class 248
8.12 Scanning Input with the Scanner class 249
Summary 250
Key Terms 250
Review Exercise 251
True or False 251
Multiple Choice Questions 251
Descriptive Questions 253

Chapter 9: Collection Classes 257
9.1 Collection Interfaces 257
9.1.1 The List Interface 258
9.1.2 The Queue Interface 259
9.2 Classes of Collection 260
9.2.1 The AbstractList Class 261
9.2.2 The ArrayList Class 262
9.2.3 The LinkedList Class 264
9.3 Legacy Classes 266
9.3.1 The Vector Class 267
9.3.2 The Properties Class 269
9.4 The Enumeration 271
9.4.1 Java Enumeration as a Class Type 272
9.4.2 Enumeration Inheriting Enum 273
9.4.3 The Enumeration Interface 274
Summary 274
Key Terms 274
Review Exercise 275
True or False 275
Multiple Choice Questions 275
Descriptive Questions 277

Chapter 10: Networking with Java.net 279
10.1 Introduction to Networking 279
10.2 Networking Enhancements in Java SE 8 280
10.3 Client-Server Networking 281
10.4 Proxy Servers 281
10.5 Domain Name Service 282
10.6 Understanding Networking Interfaces and Classes in the java.net Package 282
10.7 Internet Addressing 284
10.7.1 Understanding the InetAddress Class 285
10.7.2 Caching InetAddress 287
10.7.3 Factory Method 288
10.8 Understanding Sockets in Java 289
10.8.1 Understanding the Socket Class 289
10.9 Understanding the URL Class 293
10.10 Understanding the URI Class 294
10.10.1 URI Syntax and Components 294

10.11 Working with Datagrams 295
10.11.1 Understanding the DatagramSocket Class 295
10.11.2 Understanding DatagramPacket Class 296
Summary 300
Key Terms 300
Review Exercise 300
True or False 300
Multiple Choice Questions 301
Descriptive Questions 302

Chapter 11: Introduction to Object Orientation and Modeling Concepts 305

11.1 Object Orientation 306
11.1.1 Identity 306
11.1.2 Classification 306
11.1.3 Polymorphism 307
11.1.4 Inheritance 307
11.2 Object-Oriented Development 307
11.3 Object-Oriented Themes 308
11.3.1 Abstraction 309
11.3.2 Encapsulation 309
11.3.3 Modularity 310
11.3.4 Synergy 310
11.4 Concepts of Modeling and Modeling as a Design Technique 310
11.5 The Three Models 311
11.5.1 Class Model 311
11.5.2 State Model 311
11.5.3 Interaction Model 311
11.6 Relationship among the Models 312
Summary 313
Key Terms 313
Review Exercise 313
True or False 313
Multiple Choice Questions 314
Descriptive Questions 315

Chapter 12: Class Modeling and Advanced Class Modeling 319

12.1 Concepts of Object and Class 319
12.1.1 Class Name 320

12.1.2 Class Attributes ... 321
12.1.3 Attribute Visibility ... 321
12.1.4 Attribute Constraints ... 322
12.1.5 Class Operations List ... 322
12.1.6 Static Operations ... 323
12.2 Associations and Links ... 324
12.2.1 Binary Association ... 325
12.2.2 N-ary Association ... 325
12.2.3 Recursive Association ... 325
12.2.4 Qualified Association ... 326
12.2.5 Association Directions ... 326
12.2.6 Association Multiplicity ... 327
12.2.7 Association Class ... 328
12.3 Aggregation ... 329
12.3.1 Composition ... 329
12.3.2 Difference between Aggregation and Composition ... 329
12.4 Generalization and Inheritance ... 330
12.5 Abstract Class ... 330
12.6 Multiple Inheritance ... 331
12.7 Metadata ... 332
12.8 Constraints ... 332
12.9 Derived Data and Packages ... 333
Summary ... 334
Key Terms ... 334
Review Exercise ... 334
True or False ... 334
Multiple Choice Questions ... 335
Descriptive Questions ... 336

Chapter 13: State Modelling ... 339

13.1 Events ... 339
13.2 States ... 340
13.2.1 Composite State ... 342
13.3 Transitions and Conditions ... 342
13.4 State Diagram ... 344
13.4.1 Examples of a State Diagram ... 345
13.5 State Diagram Behavior ... 346
Summary ... 346

Key Terms 346
Review Exercise 347
True or False 347
Multiple Choice Questions 347
Descriptive Questions 348

Chapter 14: Interaction Modeling 351

14.1 Use Case Models 351
14.1.1 Elements of Use Case Model 352
14.1.2 Relationships in Use Case Model 354
14.1.3 Examples of Use Case Diagram 356
14.1.4 Guidelines for Use Case Model 357
14.1.5 Benefits of Use Case Model 358
14.2 Sequence Model 358
14.2.1 Scenario 358
14.2.2 Sequence Diagram 359
14.2.3 Guidelines for Sequence Model 363
14.2.4 Procedural Sequence Model 363
14.3 Activity Model 364
14.3.1 Component of Activity Diagram 365
14.3.2 Concepts in Activity Diagram 367
14.3.3 A Generic Activity Diagram 368
14.3.4 An Executable Activity Diagram 369
14.3.5 Guidelines for Activity Model 370
14.4 Collaboration Diagram 370
14.4.1 Examples of Collaboration Diagram 371
14.4.2 Guidelines for Drawing a Collaboration Diagram 371
14.5 Difference and Similarities between Sequence and Collaboration Diagram 372
Summary 373
Key Terms 373
Review Exercise 373
True or False 373
Multiple Choice Questions 374
Descriptive Questions 375

Index 379