Contents at a Glance

Introduction xix

Assessment Test xxv

Part I The Programmer’s Exam 1

Chapter 1 Language Fundamentals 3
Chapter 2 Operators and Assignments 29
Chapter 3 Modifiers 71
Chapter 4 Converting and Casting 97
Chapter 5 Flow Control, Assertions, and Exception Handling 123
Chapter 6 Objects and Classes 159
Chapter 7 Threads 193
Chapter 8 The java.lang and java.util Packages 227

Part II The Developer’s Exam 261

Chapter 9 Taking the Developer’s Exam 263
Chapter 10 Creating the User Interface with Swing 295
Chapter 11 Layout Managers 337
Chapter 12 Writing the Network Protocol 379
Chapter 13 Connecting Client and Server 415
Chapter 14 Enhancing and Extending the Database 439
Chapter 15 Building the Database Server 465
Appendix A Practice Exam 485
Glossary 505
Index 519
Contents

Introduction

Assessment Test

Part I The Programmer’s Exam

Chapter 1 Language Fundamentals

Source Files
Keywords and Identifiers
Primitive Data Types
Literals
  boolean Literals
  char Literals
Integral Literals
Floating-Point Literals
String Literals
Arrays
Class Fundamentals
  The main() Method
  Variables and Initialization
Argument Passing: By Reference or By Value
Garbage Collection
Summary
Exam Essentials
Key Terms
Review Questions
Answers to Review Questions

Chapter 2 Operators and Assignments

Evaluation Order
The Unary Operators
  The Increment and Decrement Operators: ++ and --
  The Unary Plus and Minus Operators: + and -
  The Bitwise Inversion Operator: ~
  The Boolean Complement Operator: !
  The Cast Operator: (type)
The Arithmetic Operators
  The Multiplication and Division Operators: * and /
  The Modulo Operator: %
  The Addition and Subtraction Operators: + and -
Arithmetic Error Conditions
Chapter 3  

Modifiers  

Chapter 3 Contents  

The Shift Operators: <<, >>, and >>>  

Fundamentals of Shifting  

Shifting Negative Numbers  

Reduction of the Right Operand  

Arithmetic Promotion of Operands  

The Comparison Operators  

Ordinal Comparisons with <, <=, >, and >=  

The instanceof Operator  

The Equality Comparison Operators: == and !=  

The Bitwise Operators: &, ^, and |  

Boolean Operations  

The Short-Circuit Logical Operators  

The Conditional Operator: ?:  

The Assignment Operators  

An Assignment Has Value  

Summary  

Exam Essentials  

Key Terms  

Review Questions  

Answers to Review Questions  

Chapter 3 Contents  

Chapter 3  

Modifiers  

Modifier Overview  

The Access Modifiers  

public  

private  

Default  

protected  

Subclasses and Method Privacy  

Summary of Access Modes  

Other Modifiers  

final  

abstract  

static  

Static Initializers  

native  

transient  

synchronized  

volatile  

Modifiers and Features  

Summary  

Exam Essentials  

Key Terms  

Review Questions  

Answers to Review Questions
<table>
<thead>
<tr>
<th>Chapter 4</th>
<th>Converting and Casting</th>
<th>97</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter 5</td>
<td>Flow Control, Assertions, and Exception Handling</td>
<td>123</td>
</tr>
<tr>
<td>Chapter 6</td>
<td>Objects and Classes</td>
<td>159</td>
</tr>
</tbody>
</table>

### Chapter 4: Converting and Casting
- Explicit and Implicit Type Changes 98
- Primitives and Conversion 99
  - Primitive Conversion: Assignment 99
  - Assignment Conversion, Narrower Primitives, and Literal Values 102
  - Primitive Conversion: Method Call 103
  - Primitive Conversion: Arithmetic Promotion 103
- Primitives and Casting 105
- Object Reference Conversion 107
  - Object Reference Assignment Conversion 108
  - Object Method-Call Conversion 110
- Object Reference Casting 111
- Summary 115
- Exam Essentials 115
- Key Terms 116
- Review Questions 117
- Answers to Review Questions 121

### Chapter 5: Flow Control, Assertions, and Exception Handling
- The Loop Constructs 124
  - The while() Loop 124
  - The do Loop 126
  - The for() Loop 126
  - The break and continue Statements in Loops 129
- The Selection Statements 131
  - The if()/else Construct 131
  - The switch() Construct 132
- Exceptions 133
  - Flow of Control in Exception Conditions 133
  - Throwing Exceptions 137
- Assertions 143
  - Assertions and Compilation 144
  - Runtime Enabling of Assertions 144
  - Using Assertions 144
- Summary 146
- Exam Essentials 147
- Key Terms 148
- Review Questions 149
- Answers to Review Questions 156

### Chapter 6: Objects and Classes
- Benefits of Object-Oriented Implementation 160
Contents

Encapsulation 160
Re-use 162
Implementing Object-Oriented Relationships 162
Overloading and Overriding 163
  Overloading Method Names 164
  Method Overriding 166
Constructors and Subclassing 170
  Overloading Constructors 172
Inner Classes 173
  The Enclosing this Reference and Construction of Inner Classes 175
  Member Classes 176
  Classes Defined Inside Methods 177
Summary 183
Exam Essentials 183
Key Terms 184
Review Questions 185
Answers to Review Questions 190

Chapter 7  Threads  193
Thread Fundamentals 194
  What a Thread Executes 195
  When Execution Ends 197
  Thread States 197
  Thread Priorities 198
Controlling Threads 199
  Yielding 199
  Suspending 201
  Sleeping 201
  Blocking 202
  Monitor States 204
  Scheduling Implementations 204
Monitors, wait(), and notify() 205
  The Object Lock and Synchronization 207
  wait() and notify() 208
  The Class Lock 213
  Beyond the Pure Model 213
  Deadlock 215
  Another Way to Synchronize 217
Summary 218
Exam Essentials 219
# Chapter 8: The `java.lang` and `java.util` Packages

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key Terms</td>
<td>220</td>
</tr>
<tr>
<td>Review Questions</td>
<td>221</td>
</tr>
<tr>
<td>Answers to Review Questions</td>
<td>225</td>
</tr>
<tr>
<td><strong>The <code>java.lang</code> Class</strong></td>
<td></td>
</tr>
<tr>
<td>The <code>Object</code> Class</td>
<td>228</td>
</tr>
<tr>
<td>The <code>Math</code> Class</td>
<td>229</td>
</tr>
<tr>
<td>The Wrapper Classes</td>
<td>231</td>
</tr>
<tr>
<td><strong>Strings</strong></td>
<td></td>
</tr>
<tr>
<td>The <code>String</code> Class</td>
<td>234</td>
</tr>
<tr>
<td>The <code>StringBuffer</code> Class</td>
<td>235</td>
</tr>
<tr>
<td>String Concatenation the Easy Way</td>
<td>238</td>
</tr>
<tr>
<td><strong>The Collections API</strong></td>
<td></td>
</tr>
<tr>
<td>Collection Types</td>
<td>241</td>
</tr>
<tr>
<td>Collections, Equality, and Sorting</td>
<td>242</td>
</tr>
<tr>
<td>The <code>hashCode()</code> Method</td>
<td>243</td>
</tr>
<tr>
<td>Collection Implementations in the API</td>
<td>244</td>
</tr>
<tr>
<td>Collections and Code Maintenance</td>
<td>245</td>
</tr>
<tr>
<td>Summary</td>
<td>246</td>
</tr>
<tr>
<td>Summary of Collections</td>
<td>247</td>
</tr>
<tr>
<td>Exam Essentials</td>
<td>248</td>
</tr>
<tr>
<td>Key Terms</td>
<td>249</td>
</tr>
<tr>
<td>Review Questions</td>
<td>250</td>
</tr>
<tr>
<td>Answers to Review Questions</td>
<td>251</td>
</tr>
<tr>
<td><strong>Part II: The Developer’s Exam</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Chapter 9: Taking the Developer’s Exam</strong></td>
<td></td>
</tr>
<tr>
<td>Are You Ready for the Exam?</td>
<td>264</td>
</tr>
<tr>
<td>Formalities of the Exam</td>
<td>265</td>
</tr>
<tr>
<td>Downloading the Assignment</td>
<td>266</td>
</tr>
<tr>
<td>Taking the Follow-up Exam</td>
<td>267</td>
</tr>
<tr>
<td>What the Assignment Covers</td>
<td>268</td>
</tr>
<tr>
<td>How the Assignment and Exam Are Graded</td>
<td>269</td>
</tr>
<tr>
<td>Structure of the Assignment</td>
<td>270</td>
</tr>
<tr>
<td>Code and APIs Provided</td>
<td>271</td>
</tr>
<tr>
<td>Example Assignment: Build a Troubles-Ticket System</td>
<td>272</td>
</tr>
<tr>
<td>GUI Development</td>
<td>273</td>
</tr>
<tr>
<td>Database/Server Development</td>
<td>274</td>
</tr>
<tr>
<td>Client-Server Logic</td>
<td>275</td>
</tr>
<tr>
<td>Coding Tips</td>
<td>276</td>
</tr>
<tr>
<td>Adhere to Supplied Naming</td>
<td>277</td>
</tr>
</tbody>
</table>
Contents

Stress Readability 275
Use Standard Design Patterns 276
Submission Requirements 276
Using javadoc 278
File Structure 279
Writing the README file 281
Using the JAR Tool 282
Preparation for the Follow-up Exam 284
What Are the Choices for Data Structures? 284
Is Implementing Runnable Better Than Extending Thread? 284
How Elaborate Should an Exception Class Structure Get? 285
How Many Ways Can You Set Up “Listener” Relationships?
   Which One Is Best? 285
How Do I Know Which Layout Manager to Use? 286
Which Design Patterns Are Most Useful in This Kind of Project? 287
When Does It Make Sense to Use protected and
default Scope? 287
Doesn’t an Abstract Class Let the Developer Specify
   More Behavior Than an Interface? 289
Summary 290
Exam Essentials 291
Key Terms 291
Review Questions 292
Answers to Review Questions 293

Chapter 10 Creating the User Interface with Swing 295
Defining the GUI’s Requirements 297
Identifying Needed Components 297
Sketching the GUI 298
Isolating Regions of Behavior 299
Choosing Layout Managers 300
Common Swing Methods 300
   getSize() and setSize() 301
   getLocation() and setLocation() 301
   setBackground() and setForeground() 301
   setFont() 301
   setEnabled() 301
Basic Swing Components 302
   Container Components 302
   Ordinary Components 305
   Menu Components 314
Building a JTable 316
   Using AbstractTableModel 319
## Contents

Review Questions 412  
Answers to Review Questions 413

### Chapter 13 Connecting Client and Server 415

- Events Basics 416  
  - Event Naming Conventions 417  
  - Event Notification 417  
- Using Java Bean Conventions 420  
- Java Beans and the MVC Design Pattern 423  
- Listeners 425  
- Remote Notification 432  
- Using Distributed Notification 434  
- Summary 435  
- Exam Essentials 435  
- Key Terms 436  
- Review Questions 437  
- Answers to Review Questions 438

### Chapter 14 Enhancing and Extending the Database 439

- Two-Tier Databases 440  
- Designing a Basic Scheme 441  
  - Using Interfaces 442  
  - Using Abstract Classes 447  
- Issues in Implementation 451  
  - Exception Handling 451  
  - Design Impediments 454  
  - Thread Safety 456  
  - Supporting New Features 459  
- Summary 460  
- Exam Essentials 460  
- Key Terms 461  
- Review Questions 462  
- Answers to Review Questions 463

### Chapter 15 Building the Database Server 465

- Database Requirements 466  
  - Implementing RMI 467  
  - Exporting with UnicastRemoteObject 471  
  - Exporting an Activatable Object 475  
- Record Locking 479  
- Summary 481  
- Exam Essentials 482  
- Key Terms 482
Contents

Review Questions 483
Answers to Review Questions 484

Appendix A

Practice Exam 485
Answers to Practice Exam 500

Glossary 505

Index 519