

Table of Contents

Preface	17
About the Authors.....	19
How This Book is Organized	20
Who Should Buy This Book?	20
Where to Find Answers to Review Questions and Exercises	20
How to Report Errata	20
Conventions Used in This Book	21
Section 1 Introductory Knowledge	23
Chapter 1 How a Computer Works	25
1.1 Introduction.....	25
1.2 What is Hardware?	25
1.3 What is Software?	26
1.4 How a Computer Executes (Runs) a Program	26
1.5 Compilers and Interpreters	26
1.6 What is Source Code?	27
1.7 Review Questions: True/False	27
1.8 Review Questions: Multiple Choice.....	28
Chapter 2 Java	31
2.1 What is Java?	31
2.2 What is the Difference Between a Script and a Program?	31
2.3 Why You Should Learn Java.....	31
2.4 How Java Works.....	31
Chapter 3 Software Packages to Install	33
3.1 Java Development Kit (JDK)	33
3.2 How to Set Up JDK.....	33
3.3 NetBeans	33
3.4 How to Set Up NetBeans IDE.....	34
Review Questions in "Introductory Knowledge"	37
Section 2 Getting Started with Java	39
Chapter 4 Introduction to Basic Algorithmic Concepts	41
4.1 What is an Algorithm?.....	41
4.2 The Algorithm for Making a Cup of Tea	41
4.3 Properties of an Algorithm	41
4.4 Okay About Algorithms. But What is a Computer Program Anyway?	42
4.5 The Party of Three!.....	42
4.6 The Three Main Stages Involved in Creating an Algorithm.....	42
4.7 Flowcharts.....	43
Exercise 4.7-1 Finding the Average Value of Three Numbers.....	44
4.8 What are "Reserved Words"?.....	45
4.9 What is the Difference Between a Statement and a Command?	45

4.10	What is Structured Programming?	46
4.11	The Three Fundamental Control Structures	46
	Exercise 4.11-1 Understanding Control Structures Using Flowcharts	47
4.12	Your First Java Program	48
4.13	What is the Difference Between Syntax Errors and Logic Errors?	48
4.14	Commenting Your Code	48
4.15	User-Friendly Programs	49
4.16	Review Questions: True/False	50
4.17	Review Questions: Multiple Choice	51
Chapter 5 Variables and Constants		53
5.1	What is a Variable?	53
5.2	What is a Constant?	55
5.3	How Many Types of Variables and Constants Exist in Java?	57
5.4	Rules for Naming Variables in Java	58
5.5	Rules for Naming Constants in Java	58
5.6	What Does the Phrase “Declare a Variable” Mean?	59
5.7	How to Declare Variables in Java	59
5.8	How to Declare Constants in Java	60
5.9	Review Questions: True/False	61
5.10	Review Questions: Multiple Choice	61
5.11	Review Exercises	62
Chapter 6 Handling Input and Output		63
6.1	Which Statement Outputs Messages and Results on a User’s Screen?	63
6.2	How to Output Special Characters	64
6.3	Which Statement Lets the User Enter Data?	66
6.4	Review Questions: True/False	68
6.5	Review Questions: Multiple Choice	68
Chapter 7 Operators		69
7.1	The Value Assignment Operator	69
7.2	Arithmetic Operators	71
7.3	What is the Precedence of Arithmetic Operators?	72
7.4	Compound Assignment Operators	73
	Exercise 7.4-1 Which Java Statements are Syntactically Correct?	73
	Exercise 7.4-2 Finding Variable Types	74
7.5	Incrementing/Decrementing Operators	74
7.6	String Operators	76
	Exercise 7.6-1 Concatenating Names	76
7.7	Review Questions: True/False	77
7.8	Review Questions: Multiple Choice	78
7.9	Review Exercises	79
Chapter 8 Trace Tables		81
8.1	What is a Trace Table?	81
	Exercise 8.1-1 Creating a Trace Table	82
	Exercise 8.1-2 Swapping Values of Variables	82
	Exercise 8.1-3 Swapping Values of Variables – A Second Approach	85

Exercise 8.1-4	Creating a Trace Table.....	85
Exercise 8.1-5	Creating a Trace Table.....	86
8.2	Review Questions: True/False.....	87
8.3	Review Exercises.....	87
Chapter 9 Using NetBeans IDE.....		89
9.1	Creating a New Java Project.....	89
9.2	Writing and Executing a Java Program.....	90
9.3	What "Debugging" Means.....	94
9.4	Debugging Java Programs with NetBeans IDE.....	95
9.5	Review Exercises.....	101
Review Questions in "Getting Started with Java".....		103
Section 3 Sequence Control Structures.....		105
Chapter 10 Introduction to Sequence Control Structures.....		107
10.1	What is the Sequence Control Structure?.....	107
Exercise 10.1-1	Calculating the Area of a Parallelogram.....	107
Exercise 10.1-2	Calculating the Area of a Circle.....	108
Exercise 10.1-3	Calculating Fuel Economy.....	108
Exercise 10.1-4	Where is the Car? Calculating Distance Traveled.....	109
Exercise 10.1-5	Kelvin to Fahrenheit.....	110
Exercise 10.1-6	Calculating Sales Tax.....	111
Exercise 10.1-7	Calculating a Sales Discount.....	111
Exercise 10.1-8	Calculating the Sales Tax Rate and Discount.....	112
10.2	Review Exercises.....	113
Chapter 11 Manipulating Numbers.....		115
11.1	Introduction.....	115
11.2	Useful Mathematical Methods (Functions).....	115
Exercise 11.2-1	Calculating the Distance Between Two Points.....	120
Exercise 11.2-2	How Far Did the Car Travel?.....	121
11.3	Review Questions: True/False.....	122
11.4	Review Questions: Multiple Choice.....	122
11.5	Review Exercises.....	123
Chapter 12 Complex Mathematical Expressions.....		125
12.1	Writing Complex Mathematical Expressions.....	125
Exercise 12.1-1	Representing Mathematical Expressions in Java.....	125
Exercise 12.1-2	Writing a Mathematical Expression in Java.....	126
Exercise 12.1-3	Writing a Complex Mathematical Expression in Java.....	126
12.2	Review Exercises.....	128
Chapter 13 Exercises With a Quotient and a Remainder.....		131
13.1	Introduction.....	131
Exercise 13.1-1	Calculating the Quotient and Remainder of Integer Division.....	131
Exercise 13.1-2	Finding the Sum of Digits.....	132
Exercise 13.1-3	Displaying an Elapsed Time.....	136
Exercise 13.1-4	Reversing a Number.....	138
13.2	Review Exercises.....	138

Chapter 14 Manipulating Strings	141
14.1 Introduction.....	141
14.2 The Position of a Character in a String.....	141
14.3 Retrieving an Individual Character From a String.....	142
Exercise 14.3-1 Displaying a String Backwards.....	142
14.4 Useful String Methods (Functions).....	143
Exercise 14.4-1 Switching the Order of Names.....	147
Exercise 14.4-2 Creating a Login ID.....	148
Exercise 14.4-3 Creating a Random Word.....	149
14.5 Review Questions: True/False	150
14.6 Review Questions: Multiple Choice	150
14.7 Review Exercises	152
Review Questions in “Sequence Control Structures”.....	153
Section 4 Decision Control Structures	155
Chapter 15 Introduction to Decision Control Structures.....	157
15.1 What is a Decision Control Structure?	157
15.2 What is a Boolean Expression?.....	157
15.3 How to Write Boolean Expressions.....	157
Exercise 15.3-1 Filling in the Table.....	158
15.4 Logical Operators and Complex Boolean Expressions.....	159
15.5 What is the Order of Precedence of Logical Operators?.....	160
15.6 What is the Order of Precedence of Arithmetic, Comparison, and Logical Operators?	160
Exercise 15.6-1 Filling in the Truth Table.....	161
Exercise 15.6-2 Calculating the Results of Complex Boolean Expressions.....	162
Exercise 15.6-3 Converting English Sentences to Boolean Expressions.....	162
15.7 How to Negate Boolean Expressions	164
Exercise 15.7-1 Negating Boolean Expressions.....	165
15.8 Review Questions: True/False	166
15.9 Review Questions: Multiple Choice	167
15.10 Review Exercises	168
Chapter 16 The Single-Alternative Decision Structure.....	171
16.1 The Single-Alternative Decision Structure	171
Exercise 16.1-1 Trace Tables and Single-Alternative Decision Structures.....	172
Exercise 16.1-2 The Absolute Value of a Number.....	173
16.2 Review Questions: True/False	174
16.3 Review Questions: Multiple Choice	175
16.4 Review Exercises	176
Chapter 17 The Dual-Alternative Decision Structure.....	179
17.1 The Dual-Alternative Decision Structure.....	179
Exercise 17.1-1 Finding the Output Message.....	179
Exercise 17.1-2 Trace Tables and Dual-Alternative Decision Structures.....	180
Exercise 17.1-3 Who is the Greatest?.....	181
Exercise 17.1-4 Finding Odd and Even Numbers.....	183
Exercise 17.1-5 Weekly Wages.....	184

17.2	Review Questions: True/False	185
17.3	Review Questions: Multiple Choice.....	186
17.4	Review Exercises.....	187
Chapter 18 The Multiple-Alternative Decision Structure.....		191
18.1	The Multiple-Alternative Decision Structure.....	191
	Exercise 18.1-1 Trace Tables and Multiple-Alternative Decision Structures.....	192
	Exercise 18.1-2 Counting the Digits.....	194
18.2	Review Questions: True/False	195
18.3	Review Exercises.....	195
Chapter 19 The Case Decision Structure.....		199
19.1	The Case Decision Structure.....	199
	Exercise 19.1-1 The Days of the Week	201
19.2	Review Questions: True/False	203
19.3	Review Exercises.....	203
Chapter 20 Nested Decision Control Structures		207
20.1	What are Nested Decision Control Structures?	207
	Exercise 20.1-1 Trace Tables and Nested Decision Control Structures	208
	Exercise 20.1-2 Positive, Negative or Zero?.....	210
20.2	A Mistake That You Will Probably Make!	211
20.3	Review Questions: True/False	215
20.4	Review Exercises.....	215
Chapter 21 Tips and Tricks with Decision Control Structures		219
21.1	Introduction.....	219
21.2	Choosing a Decision Control Structure.....	219
21.3	Streamlining the Decision Control Structure.....	220
	Exercise 21.3-1 “Shrinking” the Algorithm	221
	Exercise 21.3-2 “Shrinking” the Java program	221
	Exercise 21.3-3 “Shrinking” the Algorithm	222
21.4	Merging Two or More Single-Alternative Decision Structures.....	225
	Exercise 21.4-1 Merging the Decision Control Structures.....	226
	Exercise 21.4-2 Merging the Decision Control Structures.....	226
21.5	Replacing Two Single-Alternative Decision Structures with a Dual-Alternative One ..	228
	Exercise 21.5-1 “Merging” the Decision Control Structures.....	228
21.6	What is Code Indentation and Why is it so Important?	230
21.7	Using the “From Inner to Outer” Method in Decision Control Structures	231
21.8	Review Questions: True/False	233
21.9	Review Questions: Multiple Choice.....	233
21.10	Review Exercises.....	235
Chapter 22 Flowcharts with Decision Control Structures.....		239
22.1	Introduction.....	239
22.2	Converting Java programs to Flowcharts.....	239
	Exercise 22.2-1 Designing the Flowchart.....	240
	Exercise 22.2-2 Designing the Flowchart.....	241
	Exercise 22.2-3 Designing the Flowchart.....	242
	Exercise 22.2-4 Designing the Flowchart.....	243

22.3	Converting Flowcharts to Java programs	244
	Exercise 22.3-1 Writing the Java program.....	245
	Exercise 22.3-2 Writing the Java program.....	246
	Exercise 22.3-3 Writing the Java program.....	247
	Exercise 22.3-4 Writing the Java program.....	249
	Exercise 22.3-5 Writing the Java program.....	251
22.4	Review Exercises	252
Chapter 23 More Exercises with Decision Control Structures		259
23.1	Simple Exercises with Decision Control Structures	259
	Exercise 23.1-1 Both Odds or Both Evens?	259
	Exercise 23.1-2 Validating Data Input and Finding if a Number is Exactly Divisible by both 5 and 8?.....	259
	Exercise 23.1-3 Is it an Integer?.....	262
	Exercise 23.1-4 Converting Gallons to Liters, and Vice Versa.....	263
	Exercise 23.1-5 Converting Gallons to Liters, and Vice Versa (with Data Validation)	264
	Exercise 23.1-6 Where is the Tollkeeper?	265
	Exercise 23.1-7 The Most Scientific Calculator Ever!.....	266
23.2	Finding Minimum and Maximum Values with Decision Control Structures.....	267
	Exercise 23.2-1 Finding the Name of the Heaviest Person	269
23.3	Exercises with Series of Consecutive Ranges of Values.....	270
	Exercise 23.3-1 Calculating the Discount.....	271
	Exercise 23.3-2 Validating Data Input and Calculating the Discount	272
	Exercise 23.3-3 Sending a Parcel.....	274
	Exercise 23.3-4 Progressive Rates and Electricity Consumption	276
	Exercise 23.3-5 Progressive Rates and Text Messaging Services.....	277
23.4	Exercises of a General Nature with Decision Control Structures	278
	Exercise 23.4-1 Finding a Leap Year.....	278
	Exercise 23.4-2 Displaying the Days of the Month	280
	Exercise 23.4-3 Is the Number a Palindrome?.....	281
	Exercise 23.4-4 Checking for Proper Capitalization and Punctuation	283
23.5	Review Exercises	284
Review Questions in "Decision Control Structures"		289
Section 5 Loop Control Structures.....		291
Chapter 24 Introduction to Loop Control Structures.....		293
24.1	What is a Loop Control Structure?.....	293
24.2	From Sequence Control to Loop Control Structures.....	293
24.3	Review Questions: True/False	295
Chapter 25 The Pre-Test Loop Structure		297
25.1	The Pre-Test Loop Structure	297
	Exercise 25.1-1 Designing the Flowchart and Counting the Total Number of Iterations.....	298
	Exercise 25.1-2 Counting the Total Number of Iterations	299
	Exercise 25.1-3 Designing the Flowchart and Counting the Total Number of Iterations.....	300
	Exercise 25.1-4 Counting the Total Number of Iterations	301
	Exercise 25.1-5 Finding the Sum of 4 Numbers.....	301
	Exercise 25.1-6 Finding the Product of 20 Numbers.....	302
	Exercise 25.1-7 Finding the Product of N Numbers.....	303
	Exercise 25.1-8 Finding the Sum of Odd Numbers.....	304

Exercise 25.1-9	Finding the Sum of an Unknown Quantity of Numbers.....	305
25.2	Review Questions: True/False.....	307
25.3	Review Questions: Multiple Choice.....	307
25.4	Review Exercises.....	309
Chapter 26 The Post-Test Loop Structure		313
26.1	The Post-Test Loop Structure.....	313
Exercise 26.1-1	Designing the Flowchart and Counting the Total Number of Iterations.....	314
Exercise 26.1-2	Counting the Total Number of Iterations.....	315
Exercise 26.1-3	Designing the Flowchart and Counting the Total Number of Iterations.....	315
Exercise 26.1-4	Counting the Total Number of Iterations.....	317
Exercise 26.1-5	Finding the Product of N Numbers.....	317
Exercise 26.1-6	Finding the Product of an Unknown Quantity of Numbers.....	319
26.2	Review Questions: True/False.....	320
26.3	Review Questions: Multiple Choice.....	320
26.4	Review Exercises.....	321
Chapter 27 Counted Loop Structures		325
27.1	Counted Loop Structures.....	325
Exercise 27.1-1	Designing the Flowchart and Creating the Trace Table.....	328
Exercise 27.1-2	Creating the Trace Table.....	329
Exercise 27.1-3	Counting the Total Number of Iterations.....	330
Exercise 27.1-4	Finding the Sum of 10 Numbers.....	331
Exercise 27.1-5	Finding the Square Roots from 0 to N.....	332
27.2	Rules that Apply to Counted Loop Structures.....	333
Exercise 27.2-1	Counting the Total Number of Iterations.....	333
Exercise 27.2-2	Counting the Total Number of Iterations.....	334
Exercise 27.2-3	Counting the Total Number of Iterations.....	334
Exercise 27.2-4	Counting the Total Number of Iterations.....	335
Exercise 27.2-5	Finding the Average Value of N Numbers.....	336
27.3	Review Questions: True/False.....	337
27.4	Review Questions: Multiple Choice.....	337
27.5	Review Exercises.....	340
Chapter 28 Nested Loop Control Structures		343
28.1	What is a Nested Loop?.....	343
Exercise 28.1-1	Say “Hello Zeus”. Designing the Flowchart and Counting the Total Number of Iterations.....	344
Exercise 28.1-2	Creating the Trace Table.....	345
28.2	Rules that Apply to Nested Loops.....	346
Exercise 28.2-1	Breaking the First Rule.....	346
Exercise 28.2-2	Counting the Total Number of Iterations.....	347
28.3	Review Questions: True/False.....	348
28.4	Review Questions: Multiple Choice.....	349
28.5	Review Exercises.....	351
Chapter 29 Tips and Tricks with Loop Control Structures.....		355
29.1	Introduction.....	355
29.2	Choosing a Loop Control Structure.....	355
29.3	The “Ultimate” Rule.....	355

29.4	Breaking Out of a Loop.....	359
29.5	Cleaning Out Your Loops.....	361
	Exercise 29.5-1 Cleaning Out the Loop.....	362
	Exercise 29.5-2 Cleaning Out the Loop.....	363
29.6	Endless Loops and How to Avoid Them	364
29.7	Using the “From Inner to Outer” Method in Loop Control Structures	365
29.8	Review Questions: True/False	366
29.9	Review Questions: Multiple Choice	367
29.10	Review Exercises	368
Chapter 30 Flowcharts with Loop Control Structures.....		371
30.1	Introduction.....	371
30.2	Converting Java programs to Flowcharts	371
	Exercise 30.2-1 Designing the Flowchart.....	372
	Exercise 30.2-2 Designing the Flowchart.....	373
	Exercise 30.2-3 Designing the Flowchart.....	374
	Exercise 30.2-4 Designing the Flowchart.....	375
	Exercise 30.2-5 Designing the Flowchart.....	376
	Exercise 30.2-6 Designing the Flowchart.....	377
	Exercise 30.2-7 Designing the Flowchart.....	378
30.3	Converting Flowcharts to Java programs	379
	Exercise 30.3-1 Writing the Java program.....	380
	Exercise 30.3-2 Writing the Java program.....	381
	Exercise 30.3-3 Writing the Java program.....	382
	Exercise 30.3-4 Writing the Java program.....	384
30.4	Review Exercises	387
Chapter 31 More Exercises with Loop Control Structures		395
31.1	Simple Exercises with Loop Control Structures	395
	Exercise 31.1-1 Finding the Sum of $1 + 2 + 3 + \dots + 100$	395
	Exercise 31.1-2 Finding the Product of $2 \times 4 \times 6 \times 8 \times 10$	396
	Exercise 31.1-3 Finding the Sum of $2^2 + 4^2 + 6^2 + \dots (2N)^2$	397
	Exercise 31.1-4 Finding the Sum of $3^3 + 6^6 + 9^9 + \dots (3N)^{3N}$	398
	Exercise 31.1-5 Finding the Average Value of Positive Numbers	398
	Exercise 31.1-6 Counting the Numbers According to Which is Greater.....	399
	Exercise 31.1-7 Counting the Numbers According to Their Digits	400
	Exercise 31.1-8 How Many Numbers Fit in a Sum.....	401
	Exercise 31.1-9 Finding the Total Number of Positive Integers	401
	Exercise 31.1-10 Iterating as Many Times as the User Wishes.....	402
	Exercise 31.1-11 Finding the Sum of the Digits.....	403
	Exercise 31.1-12 Counting the Digits.....	405
31.2	Exercises with Nested Loop Control Structures	406
	Exercise 31.2-1 Displaying all Three-Digit Integers that Contain a Given Digit.....	406
	Exercise 31.2-2 Displaying all Instances of a Specified Condition	408
31.3	Data Validation with Loop Control Structures	409
	Exercise 31.3-1 Finding the Square Root - Validation Without Error Messages.....	411
	Exercise 31.3-2 Finding the Square Root - Validation with One Error Message.....	412
	Exercise 31.3-3 Finding the Square Root - Validation with Individual Error Messages	412
	Exercise 31.3-4 Finding the Sum of 10 Numbers	413
31.4	Finding Minimum and Maximum Values with Loop Control Structures	414

Exercise 31.4-1	Validating and Finding the Minimum and the Maximum Value	417
Exercise 31.4-2	Validating and Finding the Maximum Temperature	418
Exercise 31.4-3	"Making the Grade"	420
31.5	Exercises of a General Nature with Loop Control Structures	421
Exercise 31.5-1	Fahrenheit to Kelvin, from 0 to 100	421
Exercise 31.5-2	Wheat on a Chessboard	422
Exercise 31.5-3	Just a Poll.....	423
Exercise 31.5-4	Is the Message a Palindrome?.....	424
31.6	Review Questions: True/False	427
31.7	Review Exercises.....	428
	Review Questions in "Loop Control Structures"	433
Section 6	Arrays	435
	Chapter 32 Introduction to Arrays.....	437
32.1	Introduction.....	437
32.2	What is an Array?.....	438
Exercise 32.2-1	Designing an Array.....	441
Exercise 32.2-2	Designing Arrays.....	441
Exercise 32.2-3	Designing Arrays.....	442
32.3	Review Questions: True/False	443
32.4	Review Exercises.....	443
	Chapter 33 One-Dimensional Arrays.....	445
33.1	Creating One-Dimensional Arrays in Java	445
33.2	How to Get Values from One-Dimensional Arrays	446
Exercise 33.2-1	Creating the Trace Table	446
Exercise 33.2-2	Using a Non-Existing Index.....	447
33.3	How to Add Values Entered by the User to a One-Dimensional Array.....	447
33.4	How to Iterate Through a One-Dimensional Array.....	447
Exercise 33.4-1	Displaying Words in Reverse Order	448
Exercise 33.4-2	Displaying Positive Numbers in Reverse Order.....	449
Exercise 33.4-3	Displaying Even Numbers in Odd-Numbered Index Positions.....	450
Exercise 33.4-4	Finding the Sum.....	451
33.5	Review Questions: True/False	452
33.6	Review Questions: Multiple Choice.....	454
33.7	Review Exercises.....	456
	Chapter 34 Two-Dimensional Arrays	459
34.1	Creating Two-Dimensional Arrays in Java.....	459
34.2	How to Get Values from Two-Dimensional Arrays	460
Exercise 34.2-1	Creating the Trace Table	461
34.3	How to Add Values Entered by the User to a Two-Dimensional Array.....	462
34.4	How to Iterate Through a Two-Dimensional Array.....	462
Exercise 34.4-1	Displaying Reals Only	465
Exercise 34.4-2	Displaying Odd Columns Only	466
34.5	What's the Story on Variables i and j?	467
34.6	Square Arrays	467
Exercise 34.6-1	Finding the Sum of the Elements of the Main Diagonal.....	467
Exercise 34.6-2	Finding the Sum of the Elements of the Antidiagonal.....	469

Exercise 34.6-3	Filling in the Array.....	470
34.7	Review Questions: True/False	472
34.8	Review Questions: Multiple Choice	474
34.9	Review Exercises	476
Chapter 35 Tips and Tricks with Arrays.....		481
35.1	Introduction.....	481
35.2	Processing Each Row Individually.....	481
Exercise 35.2-1	Finding the Average Value.....	482
35.3	Processing Each Column Individually	484
Exercise 35.3-1	Finding the Average Value.....	486
35.4	How to Use One-Dimensional Along with Two-Dimensional Arrays	488
Exercise 35.4-1	Finding the Average Value.....	488
35.5	Creating a One-Dimensional Array from a Two-Dimensional Array.....	491
35.6	Creating a Two-Dimensional Array from a One-Dimensional Array.....	493
35.7	Review Questions: True/False	494
35.8	Review Questions: Multiple Choice	494
35.9	Review Exercises	496
Chapter 36 More Exercises with Arrays.....		499
36.1	Simple Exercises with Arrays.....	499
Exercise 36.1-1	Creating an Array that Contains the Average Values of its Neighboring Elements.....	499
Exercise 36.1-2	Creating an Array with the Greatest Values.....	501
Exercise 36.1-3	Merging One-Dimensional Arrays	503
Exercise 36.1-4	Merging Two-Dimensional Arrays	504
Exercise 36.1-5	Creating Two Arrays – Separating Positive from Negative Values	505
Exercise 36.1-6	Creating an Array with Those who Contain Digit 5.....	508
36.2	Data Validation with Arrays	510
Exercise 36.2-1	Displaying Odds in Reverse Order – Validation Without Error Messages	511
Exercise 36.2-2	Displaying Odds in Reverse Order – Validation with One Error Message.....	512
Exercise 36.2-3	Displaying Odds in Reverse Order – Validation with Individual Error Messages	513
36.3	Finding Minimum and Maximum Values in Arrays.....	514
Exercise 36.3-1	Which Depth is the Greatest?.....	514
Exercise 36.3-2	Which Lake is the Deepest?.....	515
Exercise 36.3-3	Which Lake, in Which Country, Having Which Average Area, is the Deepest?	516
Exercise 36.3-4	Which Students Have got the Greatest Grade?	518
Exercise 36.3-5	Finding the Minimum Value of a Two-Dimensional Array	519
Exercise 36.3-6	Finding the City with the Coldest Day.....	521
Exercise 36.3-7	Finding the Minimum and the Maximum Value of Each Row	522
Exercise 36.3-8	Finding the Minimum and the Maximum Value of Each Column.....	525
36.4	Sorting Arrays.....	528
Exercise 36.4-1	The Bubble Sort Algorithm – Sorting One-Dimensional Arrays with Numeric Values.....	528
Exercise 36.4-2	Sorting One-Dimensional Arrays with Alphanumeric Values	533
Exercise 36.4-3	Sorting One-Dimensional Arrays While Preserving the Relationship with a Second Array.....	534
Exercise 36.4-4	Sorting Last and First Names.....	535

Exercise 36.4-5	Sorting a Two-Dimensional Array	538
Exercise 36.4-6	Finding the Three Heaviest Weights and the Three Lightest Weights	539
Exercise 36.4-7	The Five Best Scorers.....	540
36.5	Searching Elements in Arrays.....	542
Exercise 36.5-1	The Linear Search Algorithm – Searching in a One-Dimensional Array that may Contain the Same Value Multiple Times	542
Exercise 36.5-2	Display the Last Names of All Those People Who Have the Same First Name	543
Exercise 36.5-3	Searching in a One-Dimensional Array that Contains Unique Values	544
Exercise 36.5-4	Searching for a Given Social Security Number	546
Exercise 36.5-5	Searching in a Two-Dimensional Array that may Contain the Same Value Multiple Times.....	547
Exercise 36.5-6	Searching in a Two-Dimensional Array that Contains Unique Values	548
Exercise 36.5-7	Checking if a Value Exists in all Columns	550
Exercise 36.5-8	The Binary Search Algorithm – Searching in a Sorted One-Dimensional Array	553
Exercise 36.5-9	Display all the Historical Events for a Country.....	555
Exercise 36.5-10	Searching in Each Column of a Two-Dimensional Array	557
36.6	Exercises of a General Nature with Arrays	560
Exercise 36.6-1	On Which Days was There a Possibility of Snow?.....	560
Exercise 36.6-2	Was There Any Possibility of Snow?	561
Exercise 36.6-3	In Which Cities was There a Possibility of Snow?.....	562
Exercise 36.6-4	Display from Highest to Lowest Grades by Student, and in Alphabetical Order.....	565
Exercise 36.6-5	Archery at the Summer Olympics	567
36.7	Review Questions: True/False	569
36.8	Review Exercises.....	570
	Review Questions in “Arrays”	583
Section 7	Subprograms	585
	Chapter 37 Introduction to Subprograms.....	587
37.1	What is Procedural Programming?	587
37.2	What is Modular Programming?	587
37.3	What Exactly is a Subprogram?	588
37.4	Review Questions: True/False	589
	Chapter 38 User-Defined Methods (Functions)	591
38.1	Writing your Own Methods (Functions) in Java.....	591
38.2	How Do You Call a Method?.....	592
38.3	Formal and Actual Arguments.....	594
38.4	How Does a Method Execute?.....	595
Exercise 38.4-1	Back to Basics – Calculating the Sum of Two Numbers.....	596
Exercise 38.4-2	Calculating the Sum of Two Numbers Using Fewer Lines of Code!	597
38.5	Review Questions: True/False	598
38.6	Review Exercises.....	599
	Chapter 39 User-Defined void Methods (Procedures).....	603
39.1	Writing your Own void Methods (Procedures) in Java	603
39.2	How Do You Call a void Method?	604

39.3	Formal and Actual Arguments	605
39.4	How Does a void Method Execute?	605
	Exercise 39.4-1 Back to Basics – Displaying the Absolute Value of a Number.....	607
	Exercise 39.4-2 A Simple Currency Converter.....	608
39.5	Review Questions: True/False	609
39.6	Review Exercises	610
Chapter 40 Tips and Tricks with Subprograms		613
40.1	Can Two Subprograms use Variables of the Same Name?	613
40.2	Can a Subprogram Call Another Subprogram?.....	614
	Exercise 40.2-1 A Currency Converter – Using Methods with void Methods	615
40.3	Passing Arguments by Value and by Reference	617
	Exercise 40.3-1 Finding the Logic Error	619
40.4	Returning an Array	621
40.5	Overloading Methods.....	623
40.6	The Scope of a Variable	626
40.7	Converting Parts of Code into Subprograms	627
40.8	Review Questions: True/False	632
40.9	Review Exercises	633
Chapter 41 More Exercises with Subprograms		641
41.1	Simple Exercises with Subprograms	641
	Exercise 41.1-1 Finding the Average Values of Positive Integers	641
	Exercise 41.1-2 Finding the Sum of Odd Positive Integers.....	642
	Exercise 41.1-3 Roll, Roll, Roll the... Dice!	643
	Exercise 41.1-4 How Many Times Does Each Number of the Dice Appear?	644
41.2	Exercises of a General Nature with Subprograms	646
	Exercise 41.2-1 Validating Data Input	646
	Exercise 41.2-2 Sorting an Array.....	648
	Exercise 41.2-3 Progressive Rates and Electricity Consumption.....	649
41.3	Review Exercises	651
Review Questions in “Subprograms”		663
Index.....		665
Some Final Words from the Authors		670