

Table of Contents

Preface	19
About the Author	21
Acknowledgments	22
How This Book is Organized	22
Who Should Buy This Book?	22
Conventions Used in This Book	23
How to Report Errata	24
Where to Download Material About this Book.....	24
Section 1 Introductory Knowledge	25
Chapter 1 How a Computer Works	27
1.1 Introduction	27
1.2 What is Hardware?	27
1.3 What is Software?	28
1.4 How a Computer Executes (Runs) a Program.....	28
1.5 Compilers and Interpreters.....	28
1.6 What is Source Code?	29
1.7 Review Questions: True/False	29
1.8 Review Questions: Multiple Choice.....	30
Chapter 2 PHP	33
2.1 What is PHP?	33
2.2 What is the Difference Between a Script and a Program?	33
2.3 Why You Should Learn PHP	33
2.4 How PHP Works	34
Chapter 3 Software Packages to Install	35
3.1 XAMPP.....	35
3.2 How to Set Up XAMPP	35
3.3 Visual Studio.....	39
3.4 How to Set Up Visual Studio Code on Windows	39
Review in “Introductory Knowledge”	45
Review Crossword Puzzles.....	45
Review Questions	47
Section 2 Getting Started with PHP	49
Chapter 4 Introduction to Basic Algorithmic Concepts	51
4.1 What is an Algorithm?.....	51
4.2 The Algorithm for Making a Cup of Tea	51
4.3 Properties of an Algorithm	51
4.4 Okay About Algorithms. But What is a Computer Program Anyway?.....	52
4.5 The Three Parties!	52
4.6 The Three Main Stages Involved in Creating an Algorithm.....	52
4.7 Flowcharts.....	53
Exercise 4.7-1 Finding the Average Value of Three Numbers.....	55

4.8	What are "Reserved Words"?	56
4.9	What is the Difference Between a Statement and a Command?	56
4.10	What is Structured Programming?	56
4.11	The Three Fundamental Control Structures	56
	Exercise 4.11-1 Understanding Control Structures Using Flowcharts	57
4.12	Your First PHP Script	57
4.13	What is the Difference Between a Syntax Error, a Logic Error, and a Runtime Error?	58
4.14	Commenting Your Code	59
4.15	User-Friendly Programs and Scripts	60
4.16	Review Questions: True/False	60
4.17	Review Questions: Multiple Choice	61
Chapter 5 Variables and Constants		63
5.1	What is a Variable?	63
5.2	What is a Constant?	64
5.3	How Many Types of Variables and Constants Exist?	67
5.4	Rules for Naming Variables and Constants in PHP	67
5.5	What Does the Phrase "Declare a Variable" Mean?	67
5.6	How to Declare Variables in PHP	68
5.7	How to Declare Constants in PHP	68
5.8	Review Questions: True/False	68
5.9	Review Questions: Multiple Choice	69
5.10	Review Exercises	70
Chapter 6 Handling Input and Output		71
6.1	Which Statement Outputs Messages and Results on a User's Screen?	71
6.2	How to Output Special Characters	72
6.3	Which Statement Lets the User Enter Data?	73
6.4	Review Questions: True/False	76
6.5	Review Questions: Multiple Choice	76
Chapter 7 Operators		79
7.1	The Value Assignment Operator	79
7.2	Arithmetic Operators	81
7.3	What is the Precedence of Arithmetic Operators?	82
7.4	Compound Assignment Operators	83
	Exercise 7.4-1 Which PHP Statements are Syntactically Correct?	84
	Exercise 7.4-2 Finding Variable Types	84
7.5	Incrementing/Decrementing Operators	85
7.6	String Operators	86
	Exercise 7.6-1 Concatenating Names	86
7.7	Review Questions: True/False	87
7.8	Review Questions: Multiple Choice	87
7.9	Review Exercises	89
Chapter 8 Trace Tables		91
8.1	What is a Trace Table?	91
	Exercise 8.1-1 Creating a Trace Table	91
	Exercise 8.1-2 Swapping Values of Variables	92

Exercise 8.1-3	Swapping Values of Variables – An Alternative Approach.....	94
Exercise 8.1-4	Creating a Trace Table	94
Exercise 8.1-5	Creating a Trace Table	95
8.2	Review Questions: True/False.....	96
8.3	Review Exercises.....	96
Chapter 9	Using Visual Studio Code.....	97
9.1	Writing and Executing a PHP script in Visual Studio Code	97
9.2	What “Debugging” Means.....	99
9.3	Debugging PHP scripts with Visual Studio Code.....	100
9.4	Review Exercises.....	105
	Review in “Getting Started with PHP”	107
	Review Crossword Puzzles.....	107
	Review Questions	109
Section 3	Sequence Control Structures.....	111
Chapter 10	Introduction to Sequence Control Structures	113
10.1	What is the Sequence Control Structure?.....	113
Exercise 10.1-1	Calculating the Area of a Rectangle.....	113
Exercise 10.1-2	Calculating the Area of a Circle	114
Exercise 10.1-3	Calculating Fuel Economy	115
Exercise 10.1-4	Where is the Car? Calculating Distance Traveled	115
Exercise 10.1-5	Kelvin to Fahrenheit.....	116
Exercise 10.1-6	Calculating Sales Tax.....	117
Exercise 10.1-7	Calculating a Sales Discount.....	117
Exercise 10.1-8	Calculating the Sales Tax Rate and Discount.....	118
10.2	Review Exercises.....	118
Chapter 11	Manipulating Numbers.....	121
11.1	Introduction	121
11.2	Useful Mathematical Functions (Subprograms), and More	121
Exercise 11.2-1	Calculating the Distance Between Two Points.....	125
Exercise 11.2-2	How Far Did the Car Travel?.....	125
11.3	Review Questions: True/False.....	126
11.4	Review Questions: Multiple Choice.....	127
11.5	Review Exercises.....	128
Chapter 12	Complex Mathematical Expressions	129
12.1	Writing Complex Mathematical Expressions.....	129
Exercise 12.1-1	Representing Mathematical Expressions in PHP	129
Exercise 12.1-2	Writing a Mathematical Expression in PHP.....	130
Exercise 12.1-3	Writing a Complex Mathematical Expression in PHP	130
12.2	Review Exercises.....	131
Chapter 13	Exercises With a Quotient and a Remainder.....	135
13.1	Introduction	135
Exercise 13.1-1	Calculating the Quotient and Remainder of Integer Division	135
Exercise 13.1-2	Finding the Sum of Digits.....	136
Exercise 13.1-3	Displaying an Elapsed Time	140
Exercise 13.1-4	Reversing a Number.....	141
13.2	Review Exercises.....	142

Chapter 14 Manipulating Strings	143
14.1 Introduction	143
14.2 The Position of a Character in a String	143
14.3 Useful String Functions (Subprograms), and More	143
Exercise 14.3-1 Displaying a String Backwards	147
Exercise 14.3-2 Switching the Order of Names	147
Exercise 14.3-3 Creating a Login ID	149
Exercise 14.3-4 Creating a Random Word	149
Exercise 14.3-5 Finding the Sum of Digits.....	150
14.4 Review Questions: True/False	151
14.5 Review Questions: Multiple Choice.....	151
14.6 Review Exercises.....	153
Review in “Sequence Control Structures”	155
Review Crossword Puzzle.....	155
Review Questions	155
Section 4 Decision Control Structures.....	157
Chapter 15 Making Questions.....	159
15.1 Introduction	159
15.2 What is a Boolean Expression?	159
15.3 How to Write Simple Boolean Expressions.....	159
Exercise 15.3-1 Filling in the Table	160
15.4 Logical Operators and Complex Boolean Expressions	160
15.5 Assigning the Result of a Boolean Expression to a Variable.....	162
15.6 What is the Order of Precedence of Logical Operators?	162
15.7 What is the Order of Precedence of Arithmetic, Comparison, and Logical Operators?	163
Exercise 15.7-1 Filling in the Truth Table	163
Exercise 15.7-2 Calculating the Results of Complex Boolean Expressions	165
Exercise 15.7-3 Converting English Sentences to Boolean Expressions	165
15.8 How to Negate Boolean Expressions.....	167
Exercise 15.8-1 Negating Boolean Expressions.....	168
15.9 Review Questions: True/False.....	169
15.10 Review Questions: Multiple Choice.....	170
15.11 Review Exercises.....	171
Chapter 16 The Single-Alternative Decision Structure.....	173
16.1 The Single-Alternative Decision Structure	173
Exercise 16.1-1 Trace Tables and Single-Alternative Decision Structures	175
Exercise 16.1-2 The Absolute Value of a Number	176
16.2 Review Questions: True/False	177
16.3 Review Questions: Multiple Choice.....	177
16.4 Review Exercises.....	178
Chapter 17 The Dual-Alternative Decision Structure.....	181
17.1 The Dual-Alternative Decision Structure	181
Exercise 17.1-1 Finding the Output Message	182
Exercise 17.1-2 Trace Tables and Dual-Alternative Decision Structures	182
Exercise 17.1-3 Who is the Greatest?	183
Exercise 17.1-4 Finding Odd and Even Numbers	185

Exercise 17.1-5 Weekly Wages	186
17.2 Review Questions: True/False	187
17.3 Review Questions: Multiple Choice.....	188
17.4 Review Exercises.....	189
Chapter 18 The Multiple-Alternative Decision Structure	193
18.1 The Multiple-Alternative Decision Structure	193
Exercise 18.1-1 Trace Tables and Multiple-Alternative Decision Structures	194
Exercise 18.1-2 Counting the Digits	196
18.2 Review Questions: True/False	198
18.3 Review Exercises.....	199
Chapter 19 The Case Decision Structure	203
19.1 The Case Decision Structure	203
Exercise 19.1-1 The Days of the Week.....	204
19.2 Review Questions: True/False.....	206
19.3 Review Exercises.....	207
Chapter 20 Nested Decision Control Structures.....	211
20.1 What are Nested Decision Control Structures?	211
Exercise 20.1-1 Trace Tables and Nested Decision Control Structures	212
Exercise 20.1-2 Positive, Negative or Zero?	214
20.2 A Mistake That You Will Probably Make!	215
20.3 Review Questions: True/False	218
20.4 Review Exercises.....	218
Chapter 21 More about Flowcharts with Decision Control Structures	223
21.1 Introduction	223
21.2 Converting PHP scripts to Flowcharts.....	223
Exercise 21.2-1 Designing the Flowchart	224
Exercise 21.2-2 Designing the Flowchart	225
Exercise 21.2-3 Designing the Flowchart	227
21.3 Converting Flowcharts to PHP scripts.....	228
Exercise 21.3-1 Writing the PHP Script.....	229
Exercise 21.3-2 Writing the PHP Script.....	230
Exercise 21.3-3 Writing the PHP Script.....	231
21.4 Review Exercises.....	234
Chapter 22 Tips and Tricks with Decision Control Structures.....	241
22.1 Introduction	241
22.2 Choosing a Decision Control Structure.....	241
22.3 Streamlining the Decision Control Structure.....	242
Exercise 22.3-1 “Shrinking” the Algorithm	243
Exercise 22.3-2 “Shrinking” the PHP script.....	243
Exercise 22.3-3 “Shrinking” the Algorithm	244
22.4 Logical Operators – to Use, or not to Use: That is the Question!.....	246
Exercise 22.4-1 Rewriting the Code	248
Exercise 22.4-2 Rewriting the Code	249
22.5 Merging Two or More Single-Alternative Decision Structures.....	249
Exercise 22.5-1 Merging the Decision Control Structures.....	250
Exercise 22.5-2 Merging the Decision Control Structures.....	251

22.6	Replacing Two Single-Alternative Decision Structures with a Dual-Alternative One.....	252
	Exercise 22.6-1 “Merging” the Decision Control Structures.....	253
22.7	Put the Boolean Expressions Most Likely to be True First.....	254
	Exercise 22.7-1 Rearranging the Boolean Expressions	255
22.8	Why is Code Indentation so Important?	255
22.9	Review Questions: True/False.....	256
22.10	Review Questions: Multiple Choice.....	257
22.11	Review Exercises.....	258
Chapter 23 More Exercises with Decision Control Structures		263
23.1	Simple Exercises with Decision Control Structures	263
	Exercise 23.1-1 Both Odds or Both Evens?.....	263
	Exercise 23.1-2 Is it an Integer?	263
	Exercise 23.1-3 Validating Data Input and Finding Odd and Even Numbers.....	264
	Exercise 23.1-4 Converting Gallons to Liters, and Vice Versa	265
	Exercise 23.1-5 Converting Gallons to Liters, and Vice Versa (with Data Validation)	266
	Exercise 23.1-6 Where is the Tollkeeper?.....	268
	Exercise 23.1-7 The Most Scientific Calculator Ever!	268
23.2	Decision Control Structures in Solving Mathematical Problems.....	269
	Exercise 23.2-1 Finding the Value of y	269
	Exercise 23.2-2 Finding the Values of y	270
	Exercise 23.2-3 Solving the Linear Equation $ax + b = 0$	271
	Exercise 23.2-4 Solving the Quadratic Equation $ax^2 + bx + c = 0$	273
23.3	Finding Minimum and Maximum Values with Decision Control Structures	275
	Exercise 23.3-1 Finding the Name of the Heaviest Person	277
23.4	Exercises with Series of Consecutive Ranges of Values.....	278
	Exercise 23.4-1 Calculating the Discount	279
	Exercise 23.4-2 Validating Data Input and Calculating the Discount.....	280
	Exercise 23.4-3 Sending a Parcel.....	282
	Exercise 23.4-4 Finding the Values of y	285
	Exercise 23.4-5 Progressive Rates and Electricity Consumption	287
	Exercise 23.4-6 Progressive Rates and Text Messaging Services.....	288
23.5	Exercises of a General Nature with Decision Control Structures	289
	Exercise 23.5-1 Finding a Leap Year.....	289
	Exercise 23.5-2 Displaying the Days of the Month.....	290
	Exercise 23.5-3 Is the Number a Palindrome?.....	292
	Exercise 23.5-4 Checking for Proper Capitalization and Punctuation	294
23.6	Review Exercises.....	295
Review in “Decision Control Structures”.....		299
	Review Crossword Puzzle.....	299
	Review Questions	299
Section 5 Loop Control Structures		301
Chapter 24 Introduction to Loop Control Structures.....		303
24.1	What is a Loop Control Structure?	303
24.2	From Sequence Control to Loop Control Structures	303
24.3	Review Questions: True/False.....	305
Chapter 25 Pre-Test, Mid-Test and Post-Test Loop Structures		307

25.1	The Pre-Test Loop Structure.....	307
Exercise 25.1-1	Designing the Flowchart and Counting the Total Number of Iterations.....	308
Exercise 25.1-2	Counting the Total Number of Iterations.....	309
Exercise 25.1-3	Designing the Flowchart and Counting the Total Number of Iterations.....	309
Exercise 25.1-4	Counting the Total Number of Iterations.....	310
Exercise 25.1-5	Finding the Sum of Four Numbers	310
Exercise 25.1-6	Finding the Sum of Odd Numbers.....	311
Exercise 25.1-7	Finding the Sum of N Numbers.....	312
Exercise 25.1-8	Finding the Sum of an Unknown Quantity of Numbers	313
Exercise 25.1-9	Finding the Product of 20 Numbers	314
25.2	The Post-Test Loop Structure.....	315
Exercise 25.2-1	Designing the Flowchart and Counting the Total Number of Iterations.....	316
Exercise 25.2-2	Counting the Total Number of Iterations.....	317
Exercise 25.2-3	Designing the Flowchart and Counting the Total Number of Iterations.....	317
Exercise 25.2-4	Counting the Total Number of Iterations.....	318
Exercise 25.2-5	Finding the Product of N Numbers	319
25.3	The Mid-Test Loop Structure.....	320
Exercise 25.3-1	Designing the Flowchart and Counting the Total Number of Iterations.....	321
25.4	Review Questions: True/False.....	322
25.5	Review Questions: Multiple Choice.....	323
25.6	Review Exercises.....	326
Chapter 26 The <code>for</code> statement		331
26.1	The <code>for</code> statement.....	331
Exercise 26.1-1	Creating the Trace Table.....	333
Exercise 26.1-2	Creating the Trace Table.....	335
Exercise 26.1-3	Counting the Total Number of Iterations.....	336
Exercise 26.1-4	Finding the Sum of Four Numbers	336
Exercise 26.1-5	Finding the Square Roots from 0 to N	337
Exercise 26.1-6	Finding the Sum of $1 + 2 + 3 + \dots + 100$	337
Exercise 26.1-7	Finding the Product of $2 \times 4 \times 6 \times 8 \times 10$	338
Exercise 26.1-8	Finding the Sum of $2^2 + 4^2 + 6^2 + \dots (2N)^2$	340
Exercise 26.1-9	Finding the Sum of $3^3 + 6^6 + 9^9 + \dots (3N)^{3N}$	340
Exercise 26.1-10	Finding the Average Value of Positive Numbers	340
Exercise 26.1-11	Counting the Vowels	341
26.2	Rules that Apply to For-Loops.....	342
Exercise 26.2-1	Counting the Total Number of Iterations.....	342
Exercise 26.2-2	Counting the Total Number of Iterations.....	343
Exercise 26.2-3	Counting the Total Number of Iterations.....	344
Exercise 26.2-4	Counting the Total Number of Iterations.....	344
Exercise 26.2-5	Finding the Sum of N Numbers.....	345
26.3	Review Questions: True/False.....	345
26.4	Review Questions: Multiple Choice.....	346
26.5	Review Exercises.....	349
Chapter 27 Nested Loop Control Structures.....		353
27.1	What is a Nested Loop?	353
Exercise 27.1-1	Say "Hello Zeus". Counting the Total Number of Iterations.....	354
Exercise 27.1-2	Creating the Trace Table.....	354
27.2	Rules that Apply to Nested Loops.....	356

Exercise 27.2-1	Breaking the First Rule.....	356
Exercise 27.2-2	Counting the Total Number of Iterations.....	356
27.3	Review Questions: True/False.....	357
27.4	Review Questions: Multiple Choice.....	358
27.5	Review Exercises.....	360
Chapter 28	Tips and Tricks with Loop Control Structures	363
28.1	Introduction	363
28.2	Choosing a Loop Control Structure.....	363
28.3	The “Ultimate” Rule.....	363
28.4	Breaking Out of a Loop	367
28.5	Cleaning Out Your Loops	369
Exercise 28.5-1	Cleaning Out the Loop.....	369
Exercise 28.5-2	Cleaning Out the Loop.....	370
28.6	Endless Loops and How to Avoid Them	371
28.7	The “From Inner to Outer” Method.....	371
28.8	Review Questions: True/False.....	373
28.9	Review Questions: Multiple Choice.....	374
28.10	Review Exercises.....	375
Chapter 29	Flowcharts with Loop Control Structures.....	379
29.1	Introduction	379
29.2	Converting PHP scripts to Flowcharts.....	379
Exercise 29.2-1	Designing the Flowchart Fragment	380
Exercise 29.2-2	Designing the Flowchart Fragment	380
Exercise 29.2-3	Designing the Flowchart.....	381
Exercise 29.2-4	Designing the Flowchart Fragment	382
Exercise 29.2-5	Designing the Flowchart.....	383
Exercise 29.2-6	Designing the Flowchart.....	384
29.3	Converting Flowcharts to PHP scripts.....	385
Exercise 29.3-1	Writing the PHP Script.....	386
Exercise 29.3-2	Writing the PHP Script.....	387
Exercise 29.3-3	Writing the PHP Script.....	388
Exercise 29.3-4	Writing the PHP Script.....	389
29.4	Review Exercises.....	392
Chapter 30	More Exercises with Loop Control Structures	399
30.1	Simple Exercises with Loop Control Structures.....	399
Exercise 30.1-1	Counting the Numbers According to Which is Greater.....	399
Exercise 30.1-2	Counting the Numbers According to Their Digits	400
Exercise 30.1-3	How Many Numbers Fit in a Sum	400
Exercise 30.1-4	Finding the Total Number of Positive Integers.....	401
Exercise 30.1-5	Iterating as Many Times as the User Wishes	402
Exercise 30.1-6	Finding the Sum of the Digits.....	402
30.2	Exercises with Nested Loop Control Structures	405
Exercise 30.2-1	Displaying all Three-Digit Integers that Contain a Given Digit	405
Exercise 30.2-2	Displaying all Instances of a Specified Condition	407
30.3	Data Validation with Loop Control Structures.....	408
Exercise 30.3-1	Finding Odd and Even Numbers - Validation Without Error Messages	409
Exercise 30.3-2	Finding Odd and Even Numbers - Validation with One Error Message.....	410

Exercise 30.3-3	Finding Odd and Even Numbers - Validation with Individual Error Messages.....	411
Exercise 30.3-4	Finding the Sum of Four Numbers	411
30.4	Using Loop Control Structures to Solve Mathematical Problems	412
Exercise 30.4-1	Calculating the Area of as Many Triangles as the User Wishes	412
Exercise 30.4-2	Finding x and y.....	414
Exercise 30.4-3	The Russian Multiplication Algorithm	414
Exercise 30.4-4	Finding the Number of Divisors	416
Exercise 30.4-5	Is the Number a Prime?	417
Exercise 30.4-6	Finding all Prime Numbers from 1 to N.....	418
Exercise 30.4-7	Heron's Square Root	419
Exercise 30.4-8	Calculating π	421
Exercise 30.4-9	Approximating a Real with a Fraction.....	422
30.5	Finding Minimum and Maximum Values with Loop Control Structures.....	423
Exercise 30.5-1	Validating and Finding the Minimum and the Maximum Value.....	425
Exercise 30.5-2	Validating and Finding the Hottest Planet.....	426
Exercise 30.5-3	"Making the Grade"	428
30.6	Exercises of a General Nature with Loop Control Structures.....	429
Exercise 30.6-1	Fahrenheit to Kelvin, from 0 to 100	429
Exercise 30.6-2	Rice on a Chessboard	429
Exercise 30.6-3	Just a Poll	430
Exercise 30.6-4	Is the Message a Palindrome?.....	431
30.7	Review Questions: True/False.....	433
30.8	Review Exercises.....	435
	Review in "Loop Control Structures"	441
	Review Crossword Puzzle.....	441
	Review Questions	441
Section 6	Arrays in PHP.....	443
	Chapter 31 One-Dimensional Arrays	445
31.1	Introduction	445
31.2	What is an Array?.....	445
Exercise 31.2-1	Designing an Array	447
Exercise 31.2-2	Designing Arrays.....	448
Exercise 31.2-3	Designing Arrays.....	448
31.3	Creating One-Dimensional Arrays in PHP.....	449
31.4	How to Get Values from a One-Dimensional Array.....	451
Exercise 31.4-1	Creating the Trace Table.....	451
Exercise 31.4-2	Using a Non-Existing Index.....	452
31.5	How to Alter the Value of an Array Element.....	452
31.6	How to Iterate Through a One-Dimensional Array.....	452
Exercise 31.6-1	Finding the Sum.....	454
31.7	How to Add User-Entered Values to a One-Dimensional Array.....	455
Exercise 31.7-1	Displaying Words in Reverse Order	455
Exercise 31.7-2	Displaying Positive Numbers in Reverse Order	456
Exercise 31.7-3	Finding the Average Value	456
Exercise 31.7-4	Displaying Reals Only.....	457
Exercise 31.7-5	Displaying Elements with Odd-Numbered Indexes.....	458
Exercise 31.7-6	Displaying Even Numbers in Odd-Numbered Index Positions.....	459

31.8	What is an Map?.....	459
31.9	Creating Associative Arrays in PHP	460
31.10	How to Get a Value from an Associative Array	460
	Exercise 31.10-1 Using a Non-Existing Key in Dictionaries	461
31.11	How to Alter the Value of an Element of an Associative Array	461
31.12	How to Iterate Through an Associative Array	461
31.13	Review Questions: True/False	462
31.14	Review Questions: Multiple Choice.....	464
31.15	Review Exercises.....	467
Chapter 32 Two-Dimensional Arrays		471
32.1	Creating Two-Dimensional Arrays in PHP	471
32.2	How to Get Values from Two-Dimensional Arrays.....	473
	Exercise 32.2-1 Creating the Trace Table.....	474
32.3	How to Iterate Through a Two-Dimensional Array.....	475
32.4	How to Add User-Entered Values to a Two-Dimensional Array.....	479
	Exercise 32.4-1 Displaying Reals Only.....	480
	Exercise 32.4-2 Displaying Odd Columns Only.....	480
32.5	What's the Story on Variables <i>i</i> and <i>j</i> ?.....	481
32.6	Square Matrices	481
	Exercise 32.6-1 Finding the Sum of the Elements of the Main Diagonal	482
	Exercise 32.6-2 Finding the Sum of the Elements of the Antidiagonal	483
	Exercise 32.6-3 Filling in the Array	484
32.7	Review Questions: True/False.....	486
32.8	Review Questions: Multiple Choice.....	488
32.9	Review Exercises.....	490
Chapter 33 Tips and Tricks with Arrays.....		495
33.1	Introduction	495
33.2	Processing Each Row Individually.....	495
	Exercise 33.2-1 Finding the Average Value.....	496
33.3	Processing Each Column Individually	498
	Exercise 33.3-1 Finding the Average Value.....	500
33.4	How to Use More Than One Arrays in a Program	501
	Exercise 33.4-1 Finding the Average Value of Two Grades	502
	Exercise 33.4-2 Finding the Average Value of More than Two Grades.....	503
	Exercise 33.4-3 Using an Indexed Array Along with an Associative Array.....	505
33.5	Creating a One-Dimensional Array from a Two-Dimensional Array	506
33.6	Creating a Two-Dimensional Array from a One-Dimensional Array	508
33.7	Review Questions: True/False.....	509
33.8	Review Questions: Multiple Choice.....	510
33.9	Review Exercises.....	511
Chapter 34 More Exercises with Arrays.....		515
34.1	Simple Exercises with Arrays	515
	Exercise 34.1-1 Creating an Array that Contains the Average Values of its Neighboring Elements.....	515
	Exercise 34.1-2 Creating an Array with the Greatest Values	516
	Exercise 34.1-3 Merging One-Dimensional Arrays.....	516
	Exercise 34.1-4 Merging Two-Dimensional Arrays.....	518

Exercise 34.1-5	Creating Two Arrays – Separating Positive from Negative Values.....	519
Exercise 34.1-6	Creating an Array with Those who Contain Digit 5	522
34.2	Data Validation with Arrays	524
Exercise 34.2-1	Displaying Odds in Reverse Order – Validation Without Error Messages.....	525
Exercise 34.2-2	Displaying Odds in Reverse Order – Validation with One Error Message	526
Exercise 34.2-3	Displaying Odds in Reverse Order – Validation with Individual Error Messages.....	526
34.3	Finding Minimum and Maximum Values in Arrays	527
Exercise 34.3-1	Which Depth is the Greatest?.....	527
Exercise 34.3-2	Which Lake is the Deepest?	528
Exercise 34.3-3	Which Lake, in Which Country, Having Which Average Area, is the Deepest?	529
Exercise 34.3-4	Which Students Have got the Greatest Grade?.....	531
Exercise 34.3-5	Finding the Minimum Value of a Two-Dimensional Array.....	532
Exercise 34.3-6	Finding the City with the Coldest Day	533
Exercise 34.3-7	Finding the Minimum and the Maximum Value of Each Row	535
34.4	Sorting Arrays.....	537
Exercise 34.4-1	The Bubble Sort Algorithm – Sorting One-Dimensional Arrays with Numeric Values.....	538
Exercise 34.4-2	Sorting One-Dimensional Arrays with Alphanumeric Values.....	543
Exercise 34.4-3	Sorting One-Dimensional Arrays While Preserving the Relationship with a Second Array ...	543
Exercise 34.4-4	Sorting Last and First Names.....	544
Exercise 34.4-5	Sorting a Two-Dimensional Array	547
Exercise 34.4-6	The Modified Bubble Sort Algorithm – Sorting One-Dimensional Arrays	548
Exercise 34.4-7	The Five Best Scorers	549
Exercise 34.4-8	The Selection Sort Algorithm – Sorting One-Dimensional Arrays	552
Exercise 34.4-9	Sorting One-Dimensional Arrays While Preserving the Relationship with a Second Array ...	553
Exercise 34.4-10	The Insertion Sort Algorithm – Sorting One-Dimensional Arrays.....	555
Exercise 34.4-11	The Three Worst Elapsed Times	557
34.5	Searching Elements in Arrays	558
Exercise 34.5-1	The Linear Search Algorithm – Searching in a One-Dimensional Array that may Contain the Same Value Multiple Times.....	559
Exercise 34.5-2	Display the Last Names of All Those People Who Have the Same First Name	559
Exercise 34.5-3	The Linear Search Algorithm – Searching in a One-Dimensional Array that Contains Unique Values	560
Exercise 34.5-4	Searching for a Given Social Security Number	562
Exercise 34.5-5	The Linear Search Algorithm – Searching in a Two-Dimensional Array that May Contain the Same Value Multiple Times.....	563
Exercise 34.5-6	Searching for Wins, Losses and Ties	564
Exercise 34.5-7	The Linear Search Algorithm – Searching in a Two-Dimensional Array that Contains Unique Values	565
Exercise 34.5-8	Checking if a Value Exists in all Columns	567
Exercise 34.5-9	The Binary Search Algorithm – Searching in a Sorted One-Dimensional Array	569
Exercise 34.5-10	Display all the Historical Events for a Country	571
Exercise 34.5-11	Searching in Each Column of a Two-Dimensional Array.....	572
34.6	Exercises of a General Nature with Arrays.....	575
Exercise 34.6-1	On Which Days was There a Possibility of Snow?	575
Exercise 34.6-2	Was There Any Possibility of Snow?	576
Exercise 34.6-3	In Which Cities was There a Possibility of Snow?.....	578
Exercise 34.6-4	Display from Highest to Lowest Grades by Student, and in Alphabetical Order	580
Exercise 34.6-5	Archery at the Summer Olympics.....	582
34.7	Review Questions: True/False.....	584

34.8	Review Exercises.....	585
Review in "Arrays in PHP".....		593
	Review Crossword Puzzle.....	593
	Review Questions.....	593
Section 7 Subprograms.....		595
Chapter 35 Introduction to Subprograms.....		597
35.1	What Exactly is a Subprogram?.....	597
35.2	What is Procedural Programming?.....	597
35.3	What is Modular Programming?.....	598
35.4	Review Questions: True/False.....	599
Chapter 36 User-Defined Subprograms.....		601
36.1	Subprograms that Return Values.....	601
36.2	How to Make a Call to a Function.....	602
36.3	Subprograms that Return no Values.....	604
36.4	How to Make a Call to a void Function.....	604
36.5	Formal and Actual Arguments.....	605
36.6	How Does a Function Execute?.....	606
	Exercise 36.6-1 Back to Basics – Calculating the Sum of Two Numbers.....	607
	Exercise 36.6-2 Calculating the Sum of Two Numbers Using Fewer Lines of Code!.....	608
36.7	How Does a void Function Execute?.....	609
	Exercise 36.7-1 Back to Basics – Displaying the Absolute Value of a Number.....	610
36.8	Review Questions: True/False.....	612
36.9	Review Exercises.....	613
Chapter 37 Tips and Tricks with Subprograms.....		619
37.1	Can Two Subprograms use Variables of the Same Name?.....	619
37.2	Can a Subprogram Call Another Subprogram?.....	620
37.3	Passing Arguments by Value and by Reference.....	620
	Exercise 37.3-1 Finding the Logic Error.....	623
37.4	Passing and/or Returning an Array.....	623
37.5	Default Argument Values (Optional Arguments).....	626
37.6	The Scope of a Variable.....	626
37.7	Converting Parts of Code into Subprograms.....	628
37.8	Recursion.....	632
	Exercise 37.8-1 Calculating the Fibonacci Sequence Recursively.....	634
37.9	Review Questions: True/False.....	636
37.10	Review Exercises.....	637
Chapter 38 More Exercises with Subprograms.....		643
38.1	Simple Exercises with Subprograms.....	643
	Exercise 38.1-1 Designing the Flowchart.....	643
	Exercise 38.1-2 Designing the Flowchart.....	644
	Exercise 38.1-3 A Simple Currency Converter.....	645
	Exercise 38.1-4 A More Complete Currency Converter.....	646
	Exercise 38.1-5 Finding the Average Values of Positive Integers.....	647
	Exercise 38.1-6 Finding the Sum of Odd Positive Integers.....	649
	Exercise 38.1-7 Finding the Values of y.....	649

38.2	Exercises of a General Nature with Subprograms	650
	Exercise 38.2-1 Validating Data Input Using a Subprogram	650
	Exercise 38.2-2 Sorting an Array Using a Subprogram.....	652
	Exercise 38.2-3 Progressive Rates and Electricity Consumption	653
	Exercise 38.2-4 Roll, Roll, Roll the... Dice!.....	655
	Exercise 38.2-5 How Many Times Does Each Number of the Dice Appear?	655
38.3	Review Exercises.....	657
	Review in "Subprograms"	667
	Review Crossword Puzzle.....	667
	Review Questions	668
Section 8	Object-Oriented Programming	669
	Chapter 39 Introduction to Object-Oriented Programming.....	671
39.1	What is Object-Oriented Programming?	671
39.2	Classes and Objects in PHP	672
39.3	The Constructor and the Keyword \$this	674
39.4	Passing Initial Values to the Constructor	675
	Exercise 39.4-1 Historical Events.....	676
39.5	Getter and Setter Methods	677
	Exercise 39.5-1 The Roman Numerals.....	680
39.6	Can a Method Call Another Method of the Same Class?	682
	Exercise 39.6-1 Doing Math.....	683
39.7	Class Inheritance	684
39.8	Review Questions: True/False.....	687
39.9	Review Exercises.....	688
	Review in "Object-Oriented Programming".....	693
	Review Crossword Puzzle.....	693
	Review Questions	693
Some Final Words from the Author		695
Index		696
Some of my Books		703