

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 Python	33
2.1 What is Python?	33
2.2 What is the Difference Between a Script and a Program?.....	33
2.3 Why You Should Learn Python	33
2.4 How Python Works.....	34
Chapter 3 Software Packages to Install	37
3.1 How to Set Up Python.....	37
3.2 Eclipse	37
3.3 How to Set Up Eclipse.....	38
Review in “Introductory Knowledge”	43
Review Crossword Puzzles	43
Review Questions.....	45
Section 2 Getting Started with Python	47
Chapter 4 Introduction to Basic Algorithmic Concepts	49
4.1 What is an Algorithm?.....	49
4.2 The Algorithm for Making a Cup of Tea	49
4.3 Properties of an Algorithm	49
4.4 Okay About Algorithms. But What is a Computer Program Anyway?	50
4.5 The Three Parties!.....	50
4.6 The Three Main Stages Involved in Creating an Algorithm.....	50
4.7 Flowcharts.....	51
Exercise 4.7-1 Finding the Average Value of Three Numbers.....	53
4.8 What are “Reserved Words”?.....	54

4.9	What is the Difference Between a Statement and a Command?	54
4.10	What is Structured Programming?	54
4.11	The Three Fundamental Control Structures	54
	Exercise 4.11-1 Understanding Control Structures Using Flowcharts	55
4.12	Your First Python Program	56
4.13	What is the Difference Between a Syntax Error, a Logic Error, and a Runtime Error?	56
4.14	Commenting Your Code	57
4.15	User-Friendly Programs	57
4.16	Review Questions: True/False.....	58
4.17	Review Questions: Multiple Choice	59
Chapter 5 Variables and Constants.....		61
5.1	What is a Variable?.....	61
5.2	What is a Constant?	62
5.3	How Many Types of Variables and Constants Exist?	65
5.4	Rules for Naming Variables and Constants in Python.....	65
5.5	What Does the Phrase “Declare a Variable” Mean?	66
5.6	How to Declare Variables in Python.....	66
5.7	How to Declare Constants in Python	66
5.8	Review Questions: True/False.....	66
5.9	Review Questions: Multiple Choice	67
5.10	Review Exercises	68
Chapter 6 Handling Input and Output		69
6.1	Which Statement Outputs Messages and Results on a User’s Screen?	69
6.2	How to Alter the Default Behavior of a <code>print</code> Statement.....	70
6.3	Which Statement Prompts the User to Enter Data or Lets the User Enter Data?	73
6.4	Review Questions: True/False.....	75
6.5	Review Questions: Multiple Choice	76
Chapter 7 Operators		77
7.1	The Value Assignment Operator	77
7.2	Arithmetic Operators.....	79
7.3	What is the Precedence of Arithmetic Operators?.....	80
7.4	Compound Assignment Operators.....	81
	Exercise 7.4-1 Which Python Statements are Syntactically Correct?	82
	Exercise 7.4-2 Finding Variable Types	83
7.5	String Operators.....	83
	Exercise 7.5-1 Concatenating Names	84
7.6	Review Questions: True/False.....	84
7.7	Review Questions: Multiple Choice	85
7.8	Review Exercises	86
Chapter 8 Trace Tables.....		89
8.1	What is a Trace Table?	89
	Exercise 8.1-1 Creating a Trace Table.....	89
	Exercise 8.1-2 Swapping Values of Variables	90
	Exercise 8.1-3 Swapping Values of Variables – An Alternative Approach	92
	Exercise 8.1-4 Creating a Trace Table.....	92

Exercise 8.1-5 Creating a Trace Table.....	93
8.2 Review Questions: True/False	94
8.3 Review Exercises	94
Chapter 9 Using Eclipse.....	95
9.1 Creating a New Python Project	95
9.2 Writing and Executing a Python Program.....	99
9.3 What “Debugging” Means	101
9.4 Debugging Python Programs with Eclipse.....	101
9.5 Review Exercises	108
Review in “Getting Started with Python”	109
Review Crossword Puzzles	109
Review Questions.....	111
Section 3 Sequence Control Structures.....	113
Chapter 10 Introduction to Sequence Control Structures.....	115
10.1 What is the Sequence Control Structure?.....	115
Exercise 10.1-1 Calculating the Area of a Rectangle.....	115
Exercise 10.1-2 Calculating the Area of a Circle.....	116
Exercise 10.1-3 Calculating Fuel Economy.....	117
Exercise 10.1-4 Where is the Car? Calculating Distance Traveled.....	117
Exercise 10.1-5 Kelvin to Fahrenheit.....	118
Exercise 10.1-6 Calculating Sales Tax.....	118
Exercise 10.1-7 Calculating a Sales Discount.....	119
Exercise 10.1-8 Calculating the Sales Tax Rate and Discount.....	119
10.2 Review Exercises	120
Chapter 11 Manipulating Numbers	123
11.1 Introduction.....	123
11.2 Useful Mathematical Functions (Subprograms), and More.....	124
Exercise 11.2-1 Calculating the Distance Between Two Points	129
Exercise 11.2-2 How Far Did the Car Travel?	130
11.3 Review Questions: True/False	131
11.4 Review Questions: Multiple Choice.....	131
11.5 Review Exercises	132
Chapter 12 Complex Mathematical Expressions	135
12.1 Writing Complex Mathematical Expressions.....	135
Exercise 12.1-1 Representing Mathematical Expressions in Python	135
Exercise 12.1-2 Writing a Mathematical Expression in Python.....	136
Exercise 12.1-3 Writing a Complex Mathematical Expression in Python	136
12.2 Review Exercises	137
Chapter 13 Exercises With a Quotient and a Remainder.....	139
13.1 Introduction.....	139
Exercise 13.1-1 Calculating the Quotient and Remainder of Integer Division.....	139
Exercise 13.1-2 Finding the Sum of Digits.....	140
Exercise 13.1-3 Displaying an Elapsed Time.....	144
Exercise 13.1-4 Reversing a Number	145
13.2 Review Exercises	146

Chapter 14 Manipulating Strings	147
14.1 Introduction.....	147
14.2 The Position of a Character in a String.....	147
14.3 Useful String Functions (Subprograms), and More.....	147
Exercise 14.3-1 Displaying a String Backwards.....	153
Exercise 14.3-2 Switching the Order of Names.....	154
Exercise 14.3-3 Creating a Login ID.....	155
Exercise 14.3-4 Creating a Random Word.....	155
Exercise 14.3-5 Finding the Sum of Digits.....	156
14.4 Review Questions: True/False.....	157
14.5 Review Questions: Multiple Choice.....	158
14.6 Review Exercises.....	159
Review in “Sequence Control Structures”	161
Review Crossword Puzzle.....	161
Review Questions.....	161
Section 4 Decision Control Structures	163
Chapter 15 Making Questions	165
15.1 Introduction.....	165
15.2 What is a Boolean Expression?.....	165
15.3 How to Write Simple Boolean Expressions.....	165
Exercise 15.3-1 Filling in the Table.....	166
15.4 Logical Operators and Complex Boolean Expressions.....	166
15.5 Python’s Membership Operators.....	168
15.6 Assigning the Result of a Boolean Expression to a Variable.....	169
15.7 What is the Order of Precedence of Logical Operators?.....	169
15.8 What is the Order of Precedence of Arithmetic, Comparison, and Logical Operators?.....	169
Exercise 15.8-1 Filling in the Truth Table.....	170
Exercise 15.8-2 Calculating the Results of Complex Boolean Expressions.....	171
Exercise 15.8-3 Converting English Sentences to Boolean Expressions.....	172
15.9 How to Negate Boolean Expressions.....	174
Exercise 15.9-1 Negating Boolean Expressions.....	175
15.10 Review Questions: True/False.....	176
15.11 Review Questions: Multiple Choice.....	177
15.12 Review Exercises.....	177
Chapter 16 The Single-Alternative Decision Structure	181
16.1 The Single-Alternative Decision Structure.....	181
Exercise 16.1-1 Trace Tables and Single-Alternative Decision Structures.....	183
Exercise 16.1-2 The Absolute Value of a Number.....	184
16.2 Review Questions: True/False.....	185
16.3 Review Questions: Multiple Choice.....	185
16.4 Review Exercises.....	186
Chapter 17 The Dual-Alternative Decision Structure	189
17.1 The Dual-Alternative Decision Structure.....	189
Exercise 17.1-1 Finding the Output Message.....	189
Exercise 17.1-2 Trace Tables and Dual-Alternative Decision Structures.....	190

Exercise 17.1-3 Who is the Greatest?.....	191
Exercise 17.1-4 Finding Odd and Even Numbers.....	193
Exercise 17.1-5 Weekly Wages	194
17.2 Review Questions: True/False	195
17.3 Review Questions: Multiple Choice.....	195
17.4 Review Exercises.....	196
Chapter 18 The Multiple-Alternative Decision Structure	199
18.1 The Multiple-Alternative Decision Structure.....	199
Exercise 18.1-1 Trace Tables and Multiple-Alternative Decision Structures.....	200
Exercise 18.1-2 The Days of the Week	202
Exercise 18.1-3 Counting the Digits.....	203
18.2 Review Questions: True/False	204
18.3 Review Exercises.....	205
Chapter 19 Nested Decision Control Structures.....	211
19.1 What are Nested Decision Control Structures?.....	211
Exercise 19.1-1 Trace Tables and Nested Decision Control Structures	212
Exercise 19.1-2 Positive, Negative or Zero?.....	213
19.2 A Mistake That You Will Probably Make!	214
19.3 Review Questions: True/False	218
19.4 Review Exercises.....	218
Chapter 20 More about Flowcharts with Decision Control Structures.....	221
20.1 Introduction.....	221
20.2 Converting Python Programs to Flowcharts.....	221
Exercise 20.2-1 Designing the Flowchart.....	222
Exercise 20.2-2 Designing the Flowchart.....	223
Exercise 20.2-3 Designing the Flowchart.....	224
20.3 Converting Flowcharts to Python Programs.....	225
Exercise 20.3-1 Writing the Python Program.....	226
Exercise 20.3-2 Writing the Python Program.....	227
Exercise 20.3-3 Writing the Python Program.....	228
20.4 Review Exercises.....	230
Chapter 21 Tips and Tricks with Decision Control Structures	237
21.1 Introduction.....	237
21.2 Choosing a Decision Control Structure.....	237
21.3 Streamlining the Decision Control Structure.....	238
Exercise 21.3-1 “Shrinking” the Algorithm	239
Exercise 21.3-2 “Shrinking” the Python Program.....	239
Exercise 21.3-3 “Shrinking” the Algorithm	240
21.4 Logical Operators – to Use, or not to Use: That is the Question!.....	242
Exercise 21.4-1 Rewriting the Code.....	244
Exercise 21.4-2 Rewriting the Code.....	244
21.5 Merging Two or More Single-Alternative Decision Structures	245
Exercise 21.5-1 Merging the Decision Control Structures.....	246
Exercise 21.5-2 Merging the Decision Control Structures.....	246
21.6 Replacing Two Single-Alternative Decision Structures with a Dual-Alternative One	247
Exercise 21.6-1 “Merging” the Decision Control Structures	248

21.7	Put the Boolean Expressions Most Likely to be True First	249
	Exercise 21.7-1 Rearranging the Boolean Expressions.....	250
21.8	Review Questions: True/False.....	250
21.9	Review Questions: Multiple Choice	250
21.10	Review Exercises	251
Chapter 22 More Exercises with Decision Control Structures.....		255
22.1	Simple Exercises with Decision Control Structures	255
	Exercise 22.1-1 Both Odds or Both Evens?	255
	Exercise 22.1-2 Is it an Integer?.....	255
	Exercise 22.1-3 Validating Data Input and Finding Odd and Even Numbers	256
	Exercise 22.1-4 Converting Gallons to Liters, and Vice Versa.....	257
	Exercise 22.1-5 Converting Gallons to Liters, and Vice Versa (with Data Validation).....	258
	Exercise 22.1-6 Where is the Tollkeeper?	259
	Exercise 22.1-7 The Most Scientific Calculator Ever!.....	260
22.2	Decision Control Structures in Solving Mathematical Problems.....	260
	Exercise 22.2-1 Finding the Value of y	260
	Exercise 22.2-2 Finding the Values of y	261
	Exercise 22.2-3 Solving the Linear Equation $ax + b = 0$	262
	Exercise 22.2-4 Solving the Quadratic Equation $ax^2 + bx + c = 0$	264
22.3	Finding Minimum and Maximum Values with Decision Control Structures.....	266
	Exercise 22.3-1 Finding the Name of the Heaviest Person.....	268
22.4	Exercises with Series of Consecutive Ranges of Values.....	268
	Exercise 22.4-1 Calculating the Discount.....	269
	Exercise 22.4-2 Validating Data Input and Calculating the Discount	271
	Exercise 22.4-3 Sending a Parcel.....	272
	Exercise 22.4-4 Finding the Values of y	275
	Exercise 22.4-5 Progressive Rates and Electricity Consumption.....	277
	Exercise 22.4-6 Progressive Rates and Text Messaging Services.....	278
22.5	Exercises of a General Nature with Decision Control Structures	279
	Exercise 22.5-1 Finding a Leap Year.....	279
	Exercise 22.5-2 Displaying the Days of the Month	280
	Exercise 22.5-3 Is the Number a Palindrome?.....	281
	Exercise 22.5-4 Checking for Proper Capitalization and Punctuation	283
22.6	Review Exercises	284
Review in "Decision Control Structures"		289
	Review Crossword Puzzle	289
	Review Questions	289
Section 5 Loop Control Structures.....		291
Chapter 23 Introduction to Loop Control Structures		293
23.1	What is a Loop Control Structure?.....	293
23.2	From Sequence Control to Loop Control Structures.....	293
23.3	Review Questions: True/False.....	295
Chapter 24 Pre-Test, Mid-Test and Post-Test Loop Structures		297
24.1	The Pre-Test Loop Structure	297
	Exercise 24.1-1 Designing the Flowchart and Counting the Total Number of Iterations	298
	Exercise 24.1-2 Counting the Total Number of Iterations	299
	Exercise 24.1-3 Designing the Flowchart and Counting the Total Number of Iterations	299

Exercise 24.1-4	Counting the Total Number of Iterations	300
Exercise 24.1-5	Finding the Sum of Four Numbers	300
Exercise 24.1-6	Finding the Sum of Odd Numbers.....	301
Exercise 24.1-7	Finding the Sum of N Numbers	302
Exercise 24.1-8	Finding the Sum of an Unknown Quantity of Numbers.....	303
Exercise 24.1-9	Finding the Product of 20 Numbers	304
24.2	The Post-Test Loop Structure	305
Exercise 24.2-1	Designing the Flowchart and Counting the Total Number of Iterations	306
Exercise 24.2-2	Counting the Total Number of Iterations	307
Exercise 24.2-3	Designing the Flowchart and Counting the Total Number of Iterations	308
Exercise 24.2-4	Counting the Total Number of Iterations	309
Exercise 24.2-5	Finding the Product of N Numbers.....	309
24.3	The Mid-Test Loop Structure.....	310
Exercise 24.3-1	Designing the Flowchart and Counting the Total Number of Iterations.....	311
24.4	Review Questions: True/False	313
24.5	Review Questions: Multiple Choice.....	314
24.6	Review Exercises.....	317
Chapter 25 The for statement.....		321
25.1	The for statement	321
Exercise 25.1-1	Creating the Trace Table	323
Exercise 25.1-2	Creating the Trace Table	324
Exercise 25.1-3	Counting the Total Number of Iterations	324
Exercise 25.1-4	Finding the Sum of Four Numbers	325
Exercise 25.1-5	Finding the Square Roots from 0 to N.....	325
Exercise 25.1-6	Finding the Sum of $1 + 2 + 3 + \dots + 100$	326
Exercise 25.1-7	Finding the Product of $2 \times 4 \times 6 \times 8 \times 10$	327
Exercise 25.1-8	Finding the Sum of $2^2 + 4^2 + 6^2 + \dots (2N)^2$	328
Exercise 25.1-9	Finding the Sum of $3^3 + 6^6 + 9^9 + \dots (3N)^{3N}$	328
Exercise 25.1-10	Finding the Average Value of Positive Numbers	329
Exercise 25.1-11	Counting the Vowels.....	329
25.2	Rules that Apply to For-Loops.....	330
Exercise 25.2-1	Finding the Sum of N Numbers	330
25.3	Review Questions: True/False	330
25.4	Review Questions: Multiple Choice.....	331
25.5	Review Exercises.....	334
Chapter 26 Nested Loop Control Structures.....		337
26.1	What is a Nested Loop?.....	337
Exercise 26.1-1	Say "Hello Zeus". Counting the Total Number of Iterations.....	338
Exercise 26.1-2	Creating the Trace Table	338
26.2	Rules that Apply to Nested Loops	339
Exercise 26.2-1	Breaking the First Rule	339
Exercise 26.2-2	Counting the Total Number of Iterations.....	340
26.3	Review Questions: True/False	341
26.4	Review Questions: Multiple Choice.....	342
26.5	Review Exercises.....	343
Chapter 27 Tips and Tricks with Loop Control Structures.....		347
27.1	Introduction.....	347

27.2	Choosing a Loop Control Structure.....	347
27.3	The “Ultimate” Rule	347
27.4	Breaking Out of a Loop.....	351
27.5	Cleaning Out Your Loops.....	352
	Exercise 27.5-1 Cleaning Out the Loop.....	353
	Exercise 27.5-2 Cleaning Out the Loop.....	354
27.6	Endless Loops and How to Avoid Them	354
27.7	The “From Inner to Outer” Method	355
27.8	Review Questions: True/False.....	356
27.9	Review Questions: Multiple Choice	357
27.10	Review Exercises	358
Chapter 28 Flowcharts with Loop Control Structures		361
28.1	Introduction.....	361
28.2	Converting Python Programs to Flowcharts.....	361
	Exercise 28.2-1 Designing the Flowchart.....	362
	Exercise 28.2-2 Designing the Flowchart.....	362
	Exercise 28.2-3 Designing the Flowchart.....	363
	Exercise 28.2-4 Designing the Flowchart.....	364
	Exercise 28.2-5 Designing the Flowchart.....	365
	Exercise 28.2-6 Designing the Flowchart.....	366
28.3	Converting Flowcharts to Python Programs.....	367
	Exercise 28.3-1 Writing the Python Program	368
	Exercise 28.3-2 Writing the Python Program	368
	Exercise 28.3-3 Writing the Python Program	369
	Exercise 28.3-4 Writing the Python Program	371
28.4	Review Exercises	374
Chapter 29 More Exercises with Loop Control Structures		379
29.1	Simple Exercises with Loop Control Structures	379
	Exercise 29.1-1 Counting the Numbers According to Which is Greater.....	379
	Exercise 29.1-2 Counting the Numbers According to Their Digits	380
	Exercise 29.1-3 How Many Numbers Fit in a Sum	380
	Exercise 29.1-4 Finding the Total Number of Positive Integers	381
	Exercise 29.1-5 Iterating as Many Times as the User Wishes	381
	Exercise 29.1-6 Finding the Sum of the Digits.....	382
29.2	Exercises with Nested Loop Control Structures	384
	Exercise 29.2-1 Displaying all Three-Digit Integers that Contain a Given Digit.....	384
	Exercise 29.2-2 Displaying all Instances of a Specified Condition.....	386
29.3	Data Validation with Loop Control Structures	387
	Exercise 29.3-1 Finding Odd and Even Numbers - Validation Without Error Messages	388
	Exercise 29.3-2 Finding Odd and Even Numbers - Validation with One Error Message.....	389
	Exercise 29.3-3 Finding Odd and Even Numbers - Validation with Individual Error Messages.....	390
	Exercise 29.3-4 Finding the Sum of Four Numbers.....	390
29.4	Using Loop Control Structures to Solve Mathematical Problems	391
	Exercise 29.4-1 Calculating the Area of as Many Triangles as the User Wishes.....	391
	Exercise 29.4-2 Finding x and y	392
	Exercise 29.4-3 The Russian Multiplication Algorithm	393
	Exercise 29.4-4 Finding the Number of Divisors.....	394

Exercise 29.4-5	Is the Number a Prime?.....	395
Exercise 29.4-6	Finding all Prime Numbers from 1 to N.....	396
Exercise 29.4-7	Heron's Square Root.....	397
Exercise 29.4-8	Calculating π	399
Exercise 29.4-9	Approximating a Real with a Fraction.....	400
29.5	Finding Minimum and Maximum Values with Loop Control Structures.....	401
Exercise 29.5-1	Validating and Finding the Minimum and the Maximum Value.....	402
Exercise 29.5-2	Validating and Finding the Hottest Planet.....	403
Exercise 29.5-3	"Making the Grade".....	405
29.6	Exercises of a General Nature with Loop Control Structures.....	406
Exercise 29.6-1	Fahrenheit to Kelvin, from 0 to 100.....	406
Exercise 29.6-2	Rice on a Chessboard.....	407
Exercise 29.6-3	Just a Poll.....	407
Exercise 29.6-4	Is the Message a Palindrome?.....	409
29.7	Review Questions: True/False.....	412
29.8	Review Exercises.....	413
	Review in "Loop Control Structures".....	419
	Review Crossword Puzzle.....	419
	Review Questions.....	419
Section 6	Data Structures in Python.....	421
	Chapter 30 One-Dimensional Lists and Dictionaries.....	423
30.1	Introduction.....	423
30.2	What is a List?.....	423
Exercise 30.2-1	Designing a List.....	425
Exercise 30.2-2	Designing Lists.....	426
Exercise 30.2-3	Designing Lists.....	426
30.3	Creating One-Dimensional Lists in Python.....	427
30.4	How to Get Values from a One-Dimensional List.....	429
Exercise 30.4-1	Creating the Trace Table.....	430
Exercise 30.4-2	Using a Non-Existing Index.....	430
30.5	How to Alter the Value of a List Element.....	431
30.6	How to Iterate Through a One-Dimensional List.....	431
Exercise 30.6-1	Finding the Sum.....	432
30.7	How to Add User-Entered Values to a One-Dimensional List.....	433
Exercise 30.7-1	Displaying Words in Reverse Order.....	434
Exercise 30.7-2	Displaying Positive Numbers in Reverse Order.....	435
Exercise 30.7-3	Finding the Average Value.....	435
Exercise 30.7-4	Displaying Reals Only.....	436
Exercise 30.7-5	Displaying Elements with Odd-Numbered Indexes.....	437
Exercise 30.7-6	Displaying Even Numbers in Odd-Numbered Index Positions.....	438
30.8	More about the Concatenation and Repetition Operators.....	438
30.9	What is a Dictionary?.....	439
30.10	Creating Dictionaries in Python.....	439
30.11	How to Get a Value from a Dictionary.....	440
Exercise 30.11-1	Using a Non-Existing Key in Dictionaries.....	440
30.12	How to Alter the Value of a Dictionary Element.....	441
Exercise 30.12-1	Assigning a Value to a Non-Existing Key.....	441

30.13	How to Iterate Through a Dictionary.....	441
30.14	More about the Membership Operators.....	443
30.15	Review Questions: True/False.....	443
30.16	Review Questions: Multiple Choice	446
30.17	Review Exercises	448
Chapter 31 Two-Dimensional Lists		453
31.1	Creating Two-Dimensional Lists in Python	453
31.2	How to Get Values from Two-Dimensional Lists.....	455
	Exercise 31.2-1 Creating the Trace Table	455
31.3	How to Iterate Through a Two-Dimensional List	457
31.4	How to Add User-Entered Values to a Two-Dimensional List.....	460
	Exercise 31.4-1 Displaying Reals Only.....	461
	Exercise 31.4-2 Displaying Odd Columns Only	461
31.5	What's the Story on Variables <i>i</i> and <i>j</i> ?	462
31.6	Square Matrices.....	462
	Exercise 31.6-1 Finding the Sum of the Elements of the Main Diagonal.....	462
	Exercise 31.6-2 Finding the Sum of the Elements of the Antidiagonal	464
	Exercise 31.6-3 Filling in the List.....	465
31.7	Review Questions: True/False.....	466
31.8	Review Questions: Multiple Choice	468
31.9	Review Exercises	470
Chapter 32 Tips and Tricks with Lists.....		473
32.1	Introduction.....	473
32.2	Processing Each Row Individually.....	473
	Exercise 32.2-1 Finding the Average Value.....	474
32.3	Processing Each Column Individually	477
	Exercise 32.3-1 Finding the Average Value.....	478
32.4	How to Use More Than One Data Structures in a Program.....	480
	Exercise 32.4-1 Finding the Average Value of Two Grades.....	480
	Exercise 32.4-2 Finding the Average Value of More than Two Grades.....	481
	Exercise 32.4-3 Using a List Along with a Dictionary.....	483
32.5	Creating a One-Dimensional List from a Two-Dimensional List	484
32.6	Creating a Two-Dimensional List from a One-Dimensional List	485
32.7	Useful List Functions and Methods.....	486
32.8	Review Questions: True/False.....	489
32.9	Review Questions: Multiple Choice	490
32.10	Review Exercises	492
Chapter 33 More Exercises with Lists.....		495
33.1	Simple Exercises with Lists.....	495
	Exercise 33.1-1 Creating a List that Contains the Average Values of its Neighboring Elements	495
	Exercise 33.1-2 Creating a List with the Greatest Values	496
	Exercise 33.1-3 Merging One-Dimensional Lists.....	497
	Exercise 33.1-4 Merging Two-Dimensional Lists.....	498
	Exercise 33.1-5 Creating Two Lists – Separating Positive from Negative Values	500
	Exercise 33.1-6 Creating a List with Those who Contain Digit 5.....	503
33.2	Data Validation with Lists.....	504

Exercise 33.2-1	Displaying Odds in Reverse Order – Validation Without Error Messages	506
Exercise 33.2-2	Displaying Odds in Reverse Order – Validation with One Error Message.....	507
Exercise 33.2-3	Displaying Odds in Reverse Order – Validation with Individual Error Messages.....	507
33.3	Finding Minimum and Maximum Values in Lists.....	508
Exercise 33.3-1	Which Depth is the Greatest?.....	508
Exercise 33.3-2	Which Lake is the Deepest?.....	509
Exercise 33.3-3	Which Lake, in Which Country, Having Which Average Area, is the Deepest?.....	510
Exercise 33.3-4	Which Students Have got the Greatest Grade?.....	512
Exercise 33.3-5	Finding the Minimum Value of a Two-Dimensional List.....	513
Exercise 33.3-6	Finding the City with the Coldest Day.....	514
Exercise 33.3-7	Finding the Minimum and the Maximum Value of Each Row	515
33.4	Sorting Lists.....	518
Exercise 33.4-1	The Bubble Sort Algorithm – Sorting One-Dimensional Lists with Numeric Values	519
Exercise 33.4-2	Sorting One-Dimensional Lists with Alphanumeric Values	523
Exercise 33.4-3	Sorting One-Dimensional Lists While Preserving the Relationship with a Second List.....	524
Exercise 33.4-4	Sorting Last and First Names.....	525
Exercise 33.4-5	Sorting a Two-Dimensional List.....	526
Exercise 33.4-6	The Modified Bubble Sort Algorithm – Sorting One-Dimensional Lists.....	527
Exercise 33.4-7	The Five Best Scorers.....	529
Exercise 33.4-8	The Selection Sort Algorithm – Sorting One-Dimensional Lists.....	530
Exercise 33.4-9	Sorting One-Dimensional Lists While Preserving the Relationship with a Second List.....	532
Exercise 33.4-10	The Insertion Sort Algorithm – Sorting One-Dimensional Lists	533
Exercise 33.4-11	The Three Worst Elapsed Times	535
33.5	Searching Elements in Data Structures.....	537
Exercise 33.5-1	The Linear Search Algorithm – Searching in a One-Dimensional List that may Contain the Same Value Multiple Times.....	537
Exercise 33.5-2	Display the Last Names of All Those People Who Have the Same First Name.....	538
Exercise 33.5-3	The Linear Search Algorithm – Searching in a One-Dimensional List that Contains Unique Values	538
Exercise 33.5-4	Searching for a Given Social Security Number	540
Exercise 33.5-5	The Linear Search Algorithm – Searching in a Two-Dimensional List that May Contain the Same Value Multiple Times.....	541
Exercise 33.5-6	Searching for Wins, Losses and Ties.....	542
Exercise 33.5-7	The Linear Search Algorithm – Searching in a Two-Dimensional List that Contains Unique Values	543
Exercise 33.5-8	Checking if a Value Exists in all Columns	544
Exercise 33.5-9	The Binary Search Algorithm – Searching in a Sorted One-Dimensional List.....	546
Exercise 33.5-10	Display all the Historical Events for a Country.....	548
Exercise 33.5-11	Searching in Each Column of a Two-Dimensional List.....	549
33.6	Exercises of a General Nature with Lists	552
Exercise 33.6-1	On Which Days was There a Possibility of Snow?.....	552
Exercise 33.6-2	Was There Any Possibility of Snow?	553
Exercise 33.6-3	In Which Cities was There a Possibility of Snow?.....	554
Exercise 33.6-4	Display from Highest to Lowest Grades by Student, and in Alphabetical Order.....	556
Exercise 33.6-5	Archery at the Summer Olympics.....	558
33.7	Review Questions: True/False	559
33.8	Review Exercises.....	561
	Review in “Data Structures in Python”	571
	Review Crossword Puzzle	571

Review Questions	572
Section 7 Subprograms.....	575
Chapter 34 Introduction to Subprograms	577
34.1 What Exactly is a Subprogram?.....	577
34.2 What is Procedural Programming?	577
34.3 What is Modular Programming?.....	578
34.4 Review Questions: True/False.....	579
Chapter 35 User-Defined Subprograms	581
35.1 Subprograms that Return Values	581
35.2 How to Make a Call to a Function	582
35.3 Subprograms that Return no Values	584
35.4 How to Make a Call to a void Function	585
35.5 Formal and Actual Arguments	586
35.6 How Does a Function Execute?.....	586
Exercise 35.6-1 Back to Basics – Calculating the Sum of Two Numbers.....	588
Exercise 35.6-2 Calculating the Sum of Two Numbers Using Fewer Lines of Code!	589
35.7 How Does a void Function Execute?	589
Exercise 35.7-1 Back to Basics – Displaying the Absolute Value of a Number.....	590
35.8 Review Questions: True/False.....	592
35.9 Review Exercises	593
Chapter 36 Tips and Tricks with Subprograms	599
36.1 Can Two Subprograms use Variables of the Same Name?	599
36.2 Can a Subprogram Call Another Subprogram?.....	600
36.3 Passing Arguments by Value and by Reference	600
Exercise 36.3-1 Finding the Logic Error	603
36.4 Returning a List	604
36.5 Default Argument Values and Keyword Arguments.....	607
36.6 The Scope of a Variable	608
36.7 Converting Parts of Code into Subprograms	610
36.8 Recursion	614
Exercise 36.8-1 Calculating the Fibonacci Sequence Recursively	615
36.9 Review Questions: True/False.....	617
36.10 Review Exercises	618
Chapter 37 More Exercises with Subprograms.....	625
37.1 Simple Exercises with Subprograms.....	625
Exercise 37.1-1 Designing the Flowchart.....	625
Exercise 37.1-2 Designing the Flowchart.....	626
Exercise 37.1-3 A Simple Currency Converter.....	627
Exercise 37.1-4 A More Complete Currency Converter.....	628
Exercise 37.1-5 Finding the Average Values of Positive Integers	629
Exercise 37.1-6 Finding the Sum of Odd Positive Integers.....	630
Exercise 37.1-7 Finding the Values of y	631
37.2 Exercises of a General Nature with Subprograms	632
Exercise 37.2-1 Validating Data Input Using a Subprogram.....	632
Exercise 37.2-2 Sorting a List Using a Subprogram	633

Exercise 37.2-3 Progressive Rates and Electricity Consumption.....	634
Exercise 37.2-4 Roll, Roll, Roll the... Dice!	636
Exercise 37.2-5 How Many Times Does Each Number of the Dice Appear?	636
37.3 Review Exercises.....	638
Review in “Subprograms”	649
Review Crossword Puzzle	649
Review Questions.....	650
Section 8 Object-Oriented Programming.....	651
Chapter 38 Introduction to Object-Oriented Programming	653
38.1 What is Object-Oriented Programming?.....	653
38.2 Classes and Objects in Python	654
38.3 The Constructor and the Keyword self	656
38.4 Passing Initial Values to the Constructor.....	657
38.5 Class Variables vs Instance Variables.....	659
38.6 Getter and Setter Methods vs Properties	661
Exercise 38.6-1 The Roman Numerals	664
38.7 Can a Method Call Another Method of the Same Class?	666
Exercise 38.7-1 Doing Math.....	667
38.8 Class Inheritance	668
38.9 Review Questions: True/False	671
38.10 Review Exercises.....	672
Review in “Object-Oriented Programming”	677
Review Crossword Puzzle	677
Review Questions.....	677
Some Final Words from the Author	679
Index.....	680
Some of my Books	687