CONTENTS IN DETAIL

ACKNOWLEDGMENTS **xix**

INTRODUCTION **xxi**

Who This Book Is For xxii
Why Learn Python? xxii
Installing Python xxiii
    Windows xxiii
    macOS xxiii
    Linux xxiii
How to Read This Book xxiii
Using Programming Judges xxiv
Making Your Programming Judge Accounts xxv
    The DMOJ Judge xxv
    The Timus Judge xxvi
    The USACO Judge xxvi
About This Book xxvii

1
GETTING STARTED **1**

What We'll be Doing 1
The Python Shell 2
    Windows 3
    macOS 3
    Linux 4
Problem #1: Word Count 5
    The Challenge 5
    Input 5
    Output 6
Strings 6
    Representing Strings 6
    String Operators 7
    String Methods 7
Integer and Floating-Point Numbers 9
    Variables 11
    Assignment Statement 11
    Changing Variable Values 13
Counting the Words Using a Variable 14
Reading Input 14

Writing Output 15
Solving the Problem: A Complete Python Program 16
Launching a Text Editor 16
The Program 17
Running the Program 17
Submitting to the Judge 18
Problem #2: Cone Volume 18
The Challenge 18
Input 19
Output 19
More Math in Python 19
Accessing Pi 19
Exponents 19
Converting Between Strings and Integers 20
Solving the Problem 22
Summary 23
Chapter Exercises 23
Notes 24

2
MAKING DECISIONS **25**

Problem #3: Winning Team 25
The Challenge 26
Input 26
Output 26
Conditional Execution 26
The Boolean Type 27
Relational Operators 28
The if Statement 30
if by Itself 31
if with elif 32
if with else 33
Solving the Problem 35
Problem #4: Telemarketers 37
The Challenge 37
Input 37
Output 38
Boolean Operators 38
or Operator 38
and Operator 39
not Operator 39
Solving the Problem 40
Comments 42
Input and Output Redirection 43
Summary 44
Chapter Exercises 45

Notes 45

3
REPEATING CODE: DEFINITE LOOPS **47**

Problem #5: Three Cups 47
The Challenge 48
Input 48
Output 48
Why Loops? 48
for Loops 49
Nesting 51
Solving the Problem 53
Problem #6: Occupied Spaces 56
The Challenge 56
Input 56
Output 56
A New Kind of Loop 56
Indexing 57
Range for loops 59
Range for Loops Through Indices 61
Solving the Problem 62
Problem #7: Data Plan 63
The Challenge 63
Input 63
Output 63
Looping to Read Input 63
Solving the Problem 64
Summary 66
Chapter Exercises 66
Notes 66

4
REPEATING CODE: INDEFINITE LOOPS **67**

Problem #8: Slot Machines 67
The Challenge 68
Input 68
Output 68
Exploring a Test Case 68
A Limitation of for loops 70
while loops 71
Using while loops 71
Nesting Loops in Loops 75
Adding Boolean Operators 76
Solving the Problem 77
The Mod Operator 80

F-Strings 82
Problem #9: Song Playlist 84
The Challenge 84
Input 84
Output 85
String Slicing 85
Solving the Problem 88
Problem #10: Secret Sentence 89
The Challenge 89
Input 90
Output 90
Another Limitation of for loops 90
while Loops Through Indices 91
Solving the Problem 93
break and continue 94
break 94
continue 96
Summary 97
Chapter Exercises 97
Notes 98

5
ORGANIZING VALUES USING LISTS **99**

Problem #11: Village Neighborhood 99
The Challenge 100
Input 100
Output 100
Why Lists? 100
Lists 101
List Mutability 104
Learning About Methods 106
List Methods 108
Adding to a List 109
Sorting a List 110
Removing Values from a List 110
Solving the Problem 112
Avoiding Code Duplication: Two More Solutions 114
Using a Huge Size 114
Building a List of Sizes 115
Problem #12: School Trip 116
The Challenge 116
Input 117
Output 117
A Catch 117
Splitting Strings and Joining Lists 117
Splitting a String into a List 118

Joining a List into a String 118
Changing List Values 119
Solving Most of the Problem 120
Exploring a Test Case 120
The Code 121
How to Handle the Catch 123
Exploring a Test Case 123
More List Operations 123
Finding the Index of the Maximum 124
Solving the Problem 124
Problem #13: Baker Bonus 126
The Challenge 126
Input 126
Output 126
Representing a Table 126
Exploring a Test Case 127
Nested Lists 127
Solving the Problem 130
Summary 132
Chapter Exercises 132
Notes 133

6
DESIGNING PROGRAMS WITH FUNCTIONS 135

Problem #14: Card Game 135
The Challenge 136
Input 136
Output 136
Exploring a Test Case 137
Defining and Calling Functions 138
Functions Without Arguments 139
Functions with Arguments 139
Keyword Arguments 141
Local Variables 142
Mutable Parameters 143
Return Values 145
Function Documentation 147
Solving the Problem 148
Problem #15: Action Figures 151
The Challenge 151
Input 152
Output 152
Representing the Boxes 152
Top-Down Design 152
Doing Top-Down Design 153
The Top Level 153

Task 1: Read Input 155
Task 2: Check Whether All Boxes Are OK 156
Task 3: Obtain a New List of Boxes with Only Left and Right Heights .. 158
Task 4: Sort Boxes 160
Task 5: Determine Whether Boxes Are Organized 161
Putting It All Together 162
Summary 166
Chapter Exercises 166
Notes 166

7
READING AND WRITING FILES **169**

Problem #16: Essay Formatting 169
The Challenge 170
Input 170
Output 170
Working with Files 170
Opening a File 171
Reading from a File 172
Writing to a File 175
Solving the Problem 177
Exploring a Test Case 177
The Code 178
Problem #17: Farm Seeding 180
The Challenge 180
Input 181
Output 181
Exploring a Test Case 181
Top-Down Design 184
The Top Level 184
Task 1: Read Input 185
Task 2: Identify Cows 187
Task 3: Eliminate Grass Types 189
Task 4: Choose Smallest-Numbered Grass Type 191
Task 5: Write Output 192
Summary 198
Chapter Exercises 198
Notes 198

8
ORGANIZING VALUES USING SETS AND DICTIONARIES **199**

Problem #18: Email Addresses 200
The Challenge 200
Input 200
Output 201

Using a List 201
Cleaning an Email Address 201
The Main Program 203
Efficiency of Searching a List 204
Sets 206
Set Methods 208
Efficiency of Searching a Set 209
Solving the Problem 210
Problem #19: Common Words 211
The Challenge 211
Input 212
Output 212
Exploring a Test Case 212
Dictionaries 214
Indexing Dictionaries 216
Looping Through Dictionaries 218
Inverting a Dictionary 221
Solving the Problem 223
The Code 223
Adding the Suffix 225
Finding the kth Most Common Words 225
The Main Program 226
Problem #20: Cities and States 226
The Challenge 227
Input 227
Output 227
Exploring a Test Case 227
Solving the Problem 230
Summary 231
Chapter Exercises 232
Notes 232

9
DESIGNING ALGORITHMS WITH COMPLETE SEARCH 233

Problem #21: Lifeguards 234
The Challenge 234
Input 234
Output 235
Exploring a Test Case 235
Solving the Problem 236
Firing One Lifeguard 236
The Main Program 237
Efficiency of Our Program 238
Problem #22: Ski Hills 240
The Challenge 240
Input 240

Output 240
Exploring a Test Case 240
Solving the Problem 242
Determining the Cost of One Range 242
The Main Program 243
Problem #23: Cow Baseball 245
The Challenge 245
Input 245
Output 245
Using Three Nested Loops 246
The Code 246
Efficiency of Our Program 248
Sorting First 249
The Code 249
Efficiency of Our Program 251
Python Modules 252
The bisect Module 254
Solving the Problem 256
Summary 259
Chapter Exercises 259
Notes 259

10
BIG O AND PROGRAM EFFICIENCY 261

The Problem with Timing 262
Big O 264
Constant Time 264
Linear Time 265
Quadratic Time 269
Cubic Time 272
Multiple Variables 273
Log Time 275
n log n Time 276
Handling Function Calls 278
Summary 280
Problem #24: Longest Scarf 280
The Challenge 280
Input 280
Output 281
Exploring a Test Case 281
Algorithm 1 281
Algorithm 2 282
Problem #25: Ribbon Painting 284
The Challenge 285
Input 285
Output 285

Exploring a Test Case 285
Solving the Problem 286
Summary 289
Chapter Exercises 289

AFTERWORD **291**

A
PROBLEM CREDITS **293**