

List Concatenation and List Replication . . . . .	83
Removing Values from Lists with del Statements . . . . .	84
Working with Lists . . . . .	84
Using for Loops with Lists . . . . .	86
The in and not in Operators . . . . .	87
The Multiple Assignment Trick . . . . .	87
Augmented Assignment Operators . . . . .	88
Methods . . . . .	89
Finding a Value in a List with the index() Method . . . . .	89
Adding Values to Lists with the append() and insert() Methods . . . . .	89
Removing Values from Lists with remove() . . . . .	90
Sorting the Values in a List with the sort() Method . . . . .	91
Example Program: Magic 8 Ball with a List . . . . .	92
List-like Types: Strings and Tuples . . . . .	93
Mutable and Immutable Data Types . . . . .	94
The Tuple Data Type . . . . .	96
Converting Types with the list() and tuple() Functions . . . . .	97
References . . . . .	97
Passing References . . . . .	100
The copy Module's copy() and deepcopy() Functions . . . . .	100
Summary . . . . .	101
Practice Questions . . . . .	102
Practice Projects . . . . .	102
Comma Code . . . . .	102
Character Picture Grid . . . . .	103

## 5 **DICTIONARIES AND STRUCTURING DATA** **105**

The Dictionary Data Type . . . . .	105
Dictionaries vs. Lists . . . . .	106
The keys(), values(), and items() Methods . . . . .	107
Checking Whether a Key or Value Exists in a Dictionary . . . . .	109
The get() Method . . . . .	109
The setdefault() Method . . . . .	110
Pretty Printing . . . . .	111
Using Data Structures to Model Real-World Things . . . . .	112
A Tic-Tac-Toe Board . . . . .	113
Nested Dictionaries and Lists . . . . .	117
Summary . . . . .	119
Practice Questions . . . . .	119
Practice Projects . . . . .	120
Fantasy Game Inventory . . . . .	120
List to Dictionary Function for Fantasy Game Inventory . . . . .	120

## 6 **MANIPULATING STRINGS** **123**

Working with Strings . . . . .	123
String Literals . . . . .	124
Indexing and Slicing Strings . . . . .	126
The in and not in Operators with Strings . . . . .	127

Useful String Methods . . . . .	127
The upper(), lower(), isupper(), and islower() String Methods . . . . .	128
The isX String Methods . . . . .	129
The startswith() and endswith() String Methods . . . . .	131
The join() and split() String Methods . . . . .	131
Justifying Text with rjust(), ljust(), and center() . . . . .	133
Removing Whitespace with strip(),rstrip(), and lstrip() . . . . .	134
Copying and Pasting Strings with the pyperclip Module. . . . .	135
Project: Password Locker. . . . .	136
Step 1: Program Design and Data Structures . . . . .	136
Step 2: Handle Command Line Arguments . . . . .	137
Step 3: Copy the Right Password . . . . .	137
Project: Adding Bullets to Wiki Markup. . . . .	139
Step 1: Copy and Paste from the Clipboard . . . . .	139
Step 2: Separate the Lines of Text and Add the Star . . . . .	140
Step 3: Join the Modified Lines . . . . .	141
Summary . . . . .	141
Practice Questions . . . . .	142
Practice Project . . . . .	142
Table Printer. . . . .	142

## PART II: AUTOMATING TASKS

**145**

### **7**

#### **PATTERN MATCHING WITH REGULAR EXPRESSIONS**

**147**

Finding Patterns of Text Without Regular Expressions . . . . .	148
Finding Patterns of Text with Regular Expressions . . . . .	150
Creating Regex Objects . . . . .	150
Matching Regex Objects . . . . .	151
Review of Regular Expression Matching. . . . .	152
More Pattern Matching with Regular Expressions . . . . .	152
Grouping with Parentheses. . . . .	152
Matching Multiple Groups with the Pipe. . . . .	153
Optional Matching with the Question Mark . . . . .	154
Matching Zero or More with the Star. . . . .	155
Matching One or More with the Plus . . . . .	155
Matching Specific Repetitions with Curly Brackets . . . . .	156
Greedy and Nongreedy Matching . . . . .	156
The findall() Method . . . . .	157
Character Classes . . . . .	158
Making Your Own Character Classes. . . . .	159
The Caret and Dollar Sign Characters . . . . .	159
The Wildcard Character . . . . .	160
Matching Everything with Dot-Star. . . . .	161
Matching Newlines with the Dot Character . . . . .	162
Review of Regex Symbols . . . . .	162
Case-Insensitive Matching . . . . .	163

Substituting Strings with the <code>sub()</code> Method . . . . .	163
Managing Complex Regexes. . . . .	164
Combining <code>re.IGNORECASE</code> , <code>re.DOTALL</code> , and <code>re.VERBOSE</code> . . . . .	164
Project: Phone Number and Email Address Extractor . . . . .	165
Step 1: Create a Regex for Phone Numbers . . . . .	166
Step 2: Create a Regex for Email Addresses. . . . .	166
Step 3: Find All Matches in the Clipboard Text. . . . .	167
Step 4: Join the Matches into a String for the Clipboard. . . . .	168
Running the Program . . . . .	169
Ideas for Similar Programs . . . . .	169
Summary . . . . .	169
Practice Questions . . . . .	170
Practice Projects. . . . .	171
Strong Password Detection. . . . .	171
Regex Version of <code>strip()</code> . . . . .	171

## 8 READING AND WRITING FILES 173

Files and File Paths. . . . .	173
Backslash on Windows and Forward Slash on OS X and Linux. . . . .	174
The Current Working Directory . . . . .	175
Absolute vs. Relative Paths . . . . .	175
Creating New Folders with <code>os.makedirs()</code> . . . . .	176
The <code>os.path</code> Module . . . . .	177
Handling Absolute and Relative Paths . . . . .	177
Finding File Sizes and Folder Contents. . . . .	179
Checking Path Validity. . . . .	180
The File Reading/Writing Process . . . . .	180
Opening Files with the <code>open()</code> Function . . . . .	181
Reading the Contents of Files . . . . .	182
Writing to Files . . . . .	183
Saving Variables with the <code>shelve</code> Module . . . . .	184
Saving Variables with the <code>pprint.pformat()</code> Function . . . . .	185
Project: Generating Random Quiz Files. . . . .	186
Step 1: Store the Quiz Data in a Dictionary . . . . .	187
Step 2: Create the Quiz File and Shuffle the Question Order . . . . .	188
Step 3: Create the Answer Options . . . . .	189
Step 4: Write Content to the Quiz and Answer Key Files . . . . .	189
Project: Multiclipboard . . . . .	191
Step 1: Comments and Shelf Setup . . . . .	192
Step 2: Save Clipboard Content with a Keyword . . . . .	192
Step 3: List Keywords and Load a Keyword's Content . . . . .	193
Summary . . . . .	194
Practice Questions . . . . .	194
Practice Projects. . . . .	194
Extending the Multiclipboard . . . . .	194
Mad Libs . . . . .	195
Regex Search . . . . .	195