## AUTOMATE THE BORING STUFF WITH PYTHON

Practical Programming for Total Beginners

by Al Sweigart



San Francisco

## AUTOMATE THE BORING STUFF WITH PYTHON. Copyright © 2015 by Al Sweigart.

All rights reserved. No part of this work may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage or retrieval system, without the prior written permission of the copyright owner and the publisher.

Printed in USA

Second printing

19 18 17 16 15 2 3 4 5 6 7 8 9

ISBN-10: 1-59327-599-4 ISBN-13: 978-1-59327-599-0

Publisher: William Pollock Production Editor: Laurel Chun Cover Illustration: Josh Ellingson Interior Design: Octopod Studios

Developmental Editors: Jennifer Griffith-Delgado, Greg Poulos, and Leslie Shen

Technical Reviewer: Ari Lacenski Copyeditor: Kim Wimpsett Compositor: Susan Glinert Stevens Proofreader: Lisa Devoto Farrell

Indexer: BIM Indexing and Proofreading Services

For information on distribution, translations, or bulk sales,

please contact No Starch Press, Inc. directly:

No Starch Press, Inc.

 $245\ 8\text{th}$ Street, San Francisco, CA 94103 phone: 415.863.9900; info@nostarch.com

www.nostarch.com

Library of Congress Control Number: 2014953114

No Starch Press and the No Starch Press logo are registered trademarks of No Starch Press, Inc. Other product and company names mentioned herein may be the trademarks of their respective owners. Rather than use a trademark symbol with every occurrence of a trademarked name, we are using the names only in an editorial fashion and to the benefit of the trademark owner, with no intention of infringement of the trademark.

The information in this book is distributed on an "As Is" basis, without warranty. While every precaution has been taken in the preparation of this work, neither the author nor No Starch Press, Inc. shall have any liability to any person or entity with respect to any loss or damage caused or alleged to be caused directly or indirectly by the information contained in it.

This work is licensed under the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 United States License. To view a copy of this license, visit http://creativecommons.org/licenses/by-nc-sa/3.0/us/or send a letter to Creative Commons, PO Box 1866, Mountain View, CA 94042, USA.



## AUTOMATE THE BORING STUFF WITH PYTHON. Copyright © 2015 by Al Sweigart.

All rights reserved. No part of this work may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage or retrieval system, without the prior written permission of the copyright owner and the publisher.

Printed in USA

Second printing

19 18 17 16 15 2 3 4 5 6 7 8 9

ISBN-10: 1-59327-599-4 ISBN-13: 978-1-59327-599-0

Publisher: William Pollock Production Editor: Laurel Chun Cover Illustration: Josh Ellingson Interior Design: Octopod Studios

Developmental Editors: Jennifer Griffith-Delgado, Greg Poulos, and Leslie Shen

Technical Reviewer: Ari Lacenski Copyeditor: Kim Wimpsett Compositor: Susan Glinert Stevens Proofreader: Lisa Devoto Farrell

Indexer: BIM Indexing and Proofreading Services

For information on distribution, translations, or bulk sales,

please contact No Starch Press, Inc. directly:

No Starch Press, Inc.

 $245\ 8\text{th}$ Street, San Francisco, CA 94103 phone: 415.863.9900; info@nostarch.com

www.nostarch.com

Library of Congress Control Number: 2014953114

No Starch Press and the No Starch Press logo are registered trademarks of No Starch Press, Inc. Other product and company names mentioned herein may be the trademarks of their respective owners. Rather than use a trademark symbol with every occurrence of a trademarked name, we are using the names only in an editorial fashion and to the benefit of the trademark owner, with no intention of infringement of the trademark.

The information in this book is distributed on an "As Is" basis, without warranty. While every precaution has been taken in the preparation of this work, neither the author nor No Starch Press, Inc. shall have any liability to any person or entity with respect to any loss or damage caused or alleged to be caused directly or indirectly by the information contained in it.

This work is licensed under the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 United States License. To view a copy of this license, visit http://creativecommons.org/licenses/by-nc-sa/3.0/us/or send a letter to Creative Commons, PO Box 1866, Mountain View, CA 94042, USA.





Binary Boolean Operators			
The not Operator	 		 36
Mixing Boolean and Comparison Operators			
Elements of Flow Control	 		 37
Conditions			
Blocks of Code			
Program Execution	 		 38
Flow Control Statements	 		 38
if Statements			
else Statements			
elif Statements			
while Loop Statements			
break Statements			
continue Statements			
for Loops and the range() Function			
Importing Modules			
from import Statements	 • • •	• •	 58
Ending a Program Early with sys.exit()	 	• •	 58
Summary	 • • •	• •	 50
Practice Questions			
Fractice Questions	 • • •		 37
3			
FUNCTIONS			61
def Statements with Parameters			40
Return Values and return Statements			
The None Value			
Keyword Arguments and print()			
Local and Global Scope			
Local Variables Cannot Be Used in the Global Scope			
Local Scopes Cannot Use Variables in Other Local Scopes			
Global Variables Can Be Read from a Local Scope			
Local and Global Variables with the Same Name			
The global Statement			
Exception Handling	 		 72
A Short Program: Guess the Number	 		 74
Summary			
Practice Questions			
Practice Projects			
The Collatz Sequence			
Input Validation	 		 77
Δ			
LISTS			79
The List Data Type			
Getting Individual Values in a List with Indexes	 		 80
Negative Indexes			
Getting Sublists with Slices			
Getting a List's Length with len()			
Changing Values in a List with Indexes			83

	List Concatenation and List Replication	
Working	g with Lists	
	Using for Loops with Lists	
	The in and not in Operators	
Augmen	The Multiple Assignment Trickted Assignment Operators	
	Finding a Value in a List with the index() Method	
	Adding Values to Lists with the append() and insert() Methods	
	Removing Values from Lists with remove()	
Evampla	Sorting the Values in a List with the sort() Method	
	ypes: Strings and Tuples	
LISTING	Mutable and Immutable Data Types	
	The Tuple Data Type	96
	Converting Types with the list() and tuple() Functions	97
Reference	res	
	Passing References	
Summar	тпе сору модие s соруц ана деерсоруц гипспопs	101
	Questions	
	Projects	
	Comma Code	
	Character Picture Grid	. 103
5		
_	DNARIES AND STRUCTURING DATA	105
DICTIC		
DICTIC	ionary Data Type	. 105
DICTIC	ionary Data Type	. 105 . 106 . 107
DICTIC	ionary Data Type	. 105 . 106 . 107 . 109
DICTIC	ionary Data Type	. 105 . 106 . 107 . 109
DICTIC The Dict	ionary Data Type	. 105 . 106 . 107 . 109 . 109
The Dict  Pretty Pr	ionary Data Type	. 105 . 106 . 107 . 109 . 109 . 110
The Dict  Pretty Pr	ionary Data Type .  Dictionaries vs. Lists .  The keys(), values(), and items() Methods .  Checking Whether a Key or Value Exists in a Dictionary .  The get() Method .  The setdefault() Method .  inting .  ata Structures to Model Real-World Things .  A Tic-Tac-Toe Board .	. 105 . 106 . 107 . 109 . 109 . 110 . 111 . 112
DICTIC The Dict Pretty Pr Using Do	ionary Data Type Dictionaries vs. Lists. The keys(), values(), and items() Methods Checking Whether a Key or Value Exists in a Dictionary The get() Method. The setdefault() Method inting ata Structures to Model Real-World Things A Tic-Tac-Toe Board. Nested Dictionaries and Lists	. 105 . 106 . 107 . 109 . 109 . 110 . 111 . 112 . 113
Pretty Pr Using Do	ionary Data Type .  Dictionaries vs. Lists .  The keys(), values(), and items() Methods .  Checking Whether a Key or Value Exists in a Dictionary .  The get() Method .  The setdefault() Method .  inting .  ata Structures to Model Real-World Things .  A Tic-Tac-Toe Board .  Nested Dictionaries and Lists	. 105 . 106 . 107 . 109 . 110 . 111 . 112 . 113 . 117
Pretty Pr Using Do	ionary Data Type .  Dictionaries vs. Lists .  The keys(), values(), and items() Methods .  Checking Whether a Key or Value Exists in a Dictionary .  The get() Method .  The setdefault() Method .  inting .  ata Structures to Model Real-World Things .  A Tic-Tac-Toe Board .  Nested Dictionaries and Lists .  y .  Questions .	. 105 . 106 . 107 . 109 . 109 . 110 . 111 . 112 . 113 . 117 . 119
Pretty Pr Using Do	ionary Data Type . Dictionaries vs. Lists . The keys(), values(), and items() Methods . Checking Whether a Key or Value Exists in a Dictionary . The get() Method . The setdefault() Method . inting . ata Structures to Model Real-World Things . A Tic-Tac-Toe Board . Nested Dictionaries and Lists .  y Questions . Projects .	. 105 . 106 . 107 . 109 . 110 . 111 . 112 . 113 . 117 . 119 . 120
Pretty Pr Using Do	ionary Data Type .  Dictionaries vs. Lists .  The keys(), values(), and items() Methods .  Checking Whether a Key or Value Exists in a Dictionary .  The get() Method .  The setdefault() Method .  inting .  ata Structures to Model Real-World Things .  A Tic-Tac-Toe Board .  Nested Dictionaries and Lists .  y .  Questions .	. 105 . 106 . 107 . 109 . 109 . 110 . 111 . 112 . 113 . 117 . 119 . 120 . 120
Pretty Pr Using Do Summar Practice Practice	ionary Data Type Dictionaries vs. Lists. The keys(), values(), and items() Methods Checking Whether a Key or Value Exists in a Dictionary The get() Method. The setdefault() Method inting ata Structures to Model Real-World Things A Tic-Tac-Toe Board. Nested Dictionaries and Lists y Questions Projects. Fantasy Game Inventory	. 105 . 106 . 107 . 109 . 109 . 110 . 111 . 112 . 113 . 117 . 119 . 120 . 120
Pretty Pr Using Do Summar Practice Practice	ionary Data Type Dictionaries vs. Lists. The keys(), values(), and items() Methods Checking Whether a Key or Value Exists in a Dictionary The get() Method. The setdefault() Method inting ata Structures to Model Real-World Things A Tic-Tac-Toe Board. Nested Dictionaries and Lists y Questions Projects. Fantasy Game Inventory List to Dictionary Function for Fantasy Game Inventory.	. 105 . 106 . 107 . 109 . 109 . 110 . 111 . 112 . 113 . 117 . 119 . 120 . 120
Pretty Pr Using Do Summar Practice Practice	ionary Data Type Dictionaries vs. Lists. The keys(), values(), and items() Methods Checking Whether a Key or Value Exists in a Dictionary The get() Method. The setdefault() Method inting ata Structures to Model Real-World Things A Tic-Tac-Toe Board. Nested Dictionaries and Lists y Questions Projects. Fantasy Game Inventory List to Dictionary Function for Fantasy Game Inventory.	. 105 . 106 . 107 . 109 . 110 . 111 . 112 . 113 . 117 . 119 . 120 . 120
Pretty Pr Using Do Summar Practice Practice	ionary Data Type Dictionaries vs. Lists. The keys(), values(), and items() Methods Checking Whether a Key or Value Exists in a Dictionary The get() Method. The setdefault() Method inting ata Structures to Model Real-World Things A Tic-Tac-Toe Board. Nested Dictionaries and Lists y Questions Projects. Fantasy Game Inventory List to Dictionary Function for Fantasy Game Inventory.  PULATING STRINGS g with Strings	. 105 . 106 . 107 . 109 . 110 . 111 . 112 . 113 . 117 . 119 . 120 . 120
Pretty Pr Using Do Summar Practice Practice	ionary Data Type Dictionaries vs. Lists. The keys(), values(), and items() Methods Checking Whether a Key or Value Exists in a Dictionary The get() Method. The setdefault() Method inting ata Structures to Model Real-World Things A Tic-Tac-Toe Board. Nested Dictionaries and Lists y Questions Projects. Fantasy Game Inventory List to Dictionary Function for Fantasy Game Inventory.	. 105 . 106 . 107 . 109 . 110 . 111 . 112 . 113 . 117 . 119 . 120 . 120 . 120

	List Concatenation and List Replication	
Working	g with Lists	
	Using for Loops with Lists	
	The in and not in Operators	
Augmen	The Multiple Assignment Trickted Assignment Operators	
	Finding a Value in a List with the index() Method	
	Adding Values to Lists with the append() and insert() Methods	
	Removing Values from Lists with remove()	
Evampla	Sorting the Values in a List with the sort() Method	
	ypes: Strings and Tuples	
LISTING	Mutable and Immutable Data Types	
	The Tuple Data Type	96
	Converting Types with the list() and tuple() Functions	97
Reference	res	
	Passing References	
Summar	тпе сору модие s соруц ана деерсоруц гипспопs	101
	Questions	
	Projects	
	Comma Code	
	Character Picture Grid	. 103
5		
_	DNARIES AND STRUCTURING DATA	105
DICTIC		
DICTIC	ionary Data Type	. 105
DICTIC	ionary Data Type	. 105 . 106 . 107
DICTIC	ionary Data Type	. 105 . 106 . 107 . 109
DICTIC	ionary Data Type	. 105 . 106 . 107 . 109
DICTIC The Dict	ionary Data Type	. 105 . 106 . 107 . 109 . 109
The Dict  Pretty Pr	ionary Data Type	. 105 . 106 . 107 . 109 . 109 . 110
The Dict  Pretty Pr	ionary Data Type .  Dictionaries vs. Lists .  The keys(), values(), and items() Methods .  Checking Whether a Key or Value Exists in a Dictionary .  The get() Method .  The setdefault() Method .  inting .  ata Structures to Model Real-World Things .  A Tic-Tac-Toe Board .	. 105 . 106 . 107 . 109 . 109 . 110 . 111 . 112
DICTIC The Dict Pretty Pr Using Do	ionary Data Type Dictionaries vs. Lists. The keys(), values(), and items() Methods Checking Whether a Key or Value Exists in a Dictionary The get() Method. The setdefault() Method inting ata Structures to Model Real-World Things A Tic-Tac-Toe Board. Nested Dictionaries and Lists	. 105 . 106 . 107 . 109 . 109 . 110 . 111 . 112 . 113
Pretty Pr Using Do	ionary Data Type .  Dictionaries vs. Lists .  The keys(), values(), and items() Methods .  Checking Whether a Key or Value Exists in a Dictionary .  The get() Method .  The setdefault() Method .  inting .  ata Structures to Model Real-World Things .  A Tic-Tac-Toe Board .  Nested Dictionaries and Lists	. 105 . 106 . 107 . 109 . 110 . 111 . 112 . 113 . 117
Pretty Pr Using Do	ionary Data Type .  Dictionaries vs. Lists .  The keys(), values(), and items() Methods .  Checking Whether a Key or Value Exists in a Dictionary .  The get() Method .  The setdefault() Method .  inting .  ata Structures to Model Real-World Things .  A Tic-Tac-Toe Board .  Nested Dictionaries and Lists .  y .  Questions .	. 105 . 106 . 107 . 109 . 109 . 110 . 111 . 112 . 113 . 117 . 119
Pretty Pr Using Do	ionary Data Type . Dictionaries vs. Lists . The keys(), values(), and items() Methods . Checking Whether a Key or Value Exists in a Dictionary . The get() Method . The setdefault() Method . inting . ata Structures to Model Real-World Things . A Tic-Tac-Toe Board . Nested Dictionaries and Lists .  y Questions . Projects .	. 105 . 106 . 107 . 109 . 110 . 111 . 112 . 113 . 117 . 119 . 120
Pretty Pr Using Do	ionary Data Type .  Dictionaries vs. Lists .  The keys(), values(), and items() Methods .  Checking Whether a Key or Value Exists in a Dictionary .  The get() Method .  The setdefault() Method .  inting .  ata Structures to Model Real-World Things .  A Tic-Tac-Toe Board .  Nested Dictionaries and Lists .  y .  Questions .	. 105 . 106 . 107 . 109 . 109 . 110 . 111 . 112 . 113 . 117 . 119 . 120 . 120
Pretty Pr Using Do Summar Practice Practice	ionary Data Type Dictionaries vs. Lists. The keys(), values(), and items() Methods Checking Whether a Key or Value Exists in a Dictionary The get() Method. The setdefault() Method inting ata Structures to Model Real-World Things A Tic-Tac-Toe Board. Nested Dictionaries and Lists y Questions Projects. Fantasy Game Inventory	. 105 . 106 . 107 . 109 . 110 . 111 . 112 . 113 . 117 . 119 . 120 . 120
Pretty Pr Using Do Summar Practice Practice	ionary Data Type Dictionaries vs. Lists. The keys(), values(), and items() Methods Checking Whether a Key or Value Exists in a Dictionary The get() Method. The setdefault() Method inting ata Structures to Model Real-World Things A Tic-Tac-Toe Board. Nested Dictionaries and Lists y Questions Projects. Fantasy Game Inventory List to Dictionary Function for Fantasy Game Inventory.	. 105 . 106 . 107 . 109 . 110 . 111 . 112 . 113 . 117 . 119 . 120 . 120
Pretty Pr Using Do Summar Practice Practice	ionary Data Type Dictionaries vs. Lists. The keys(), values(), and items() Methods Checking Whether a Key or Value Exists in a Dictionary The get() Method. The setdefault() Method inting ata Structures to Model Real-World Things A Tic-Tac-Toe Board. Nested Dictionaries and Lists y Questions Projects. Fantasy Game Inventory List to Dictionary Function for Fantasy Game Inventory.	. 105 . 106 . 107 . 109 . 110 . 111 . 112 . 113 . 117 . 119 . 120 . 120
Pretty Pr Using Do Summar Practice Practice	ionary Data Type Dictionaries vs. Lists. The keys(), values(), and items() Methods Checking Whether a Key or Value Exists in a Dictionary The get() Method. The setdefault() Method inting ata Structures to Model Real-World Things A Tic-Tac-Toe Board. Nested Dictionaries and Lists y Questions Projects. Fantasy Game Inventory List to Dictionary Function for Fantasy Game Inventory.  PULATING STRINGS g with Strings	. 105 . 106 . 107 . 109 . 110 . 111 . 112 . 113 . 117 . 119 . 120 . 120
Pretty Pr Using Do Summar Practice Practice	ionary Data Type Dictionaries vs. Lists. The keys(), values(), and items() Methods Checking Whether a Key or Value Exists in a Dictionary The get() Method. The setdefault() Method inting ata Structures to Model Real-World Things A Tic-Tac-Toe Board. Nested Dictionaries and Lists y Questions Projects. Fantasy Game Inventory List to Dictionary Function for Fantasy Game Inventory.	. 105 . 106 . 107 . 109 . 110 . 111 . 112 . 113 . 117 . 119 . 120 . 120 . 120

Useful String Methods	127
The upper(), lower(), isupper(), and islower() String Methods	
The isX String Methods	129
The startswith() and endswith() String Methods	131
The join() and split() String Methods	
Justifying Text with rjust(), ljust(), and center()	
Removing Whitespace with strip(), rstrip(), and lstrip()	
Copying and Pasting Strings with the pyperclip Module	135
Project: Password Locker	
Step 1: Program Design and Data Structures	
Step 2: Handle Command Line Arguments	
Step 3: Copy the Right Password	
Project: Adding Bullets to Wiki Markup	
Step 1: Copy and Paste from the Clipboard	
Step 2: Separate the Lines of Text and Add the Star	
Step 3: Join the Modified Lines	
Summary	
Practice Questions	
Practice Project	
Table Printer	
PART II: AUTOMATING TASKS	145
PART II: AUTOMATING TASKS	145
PART II: AUTOMATING TASKS	145
7	145 147
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS	147
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS Finding Patterns of Text Without Regular Expressions	<b>147</b>
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS Finding Patterns of Text Without Regular Expressions	<b>147</b> 148 150
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS Finding Patterns of Text Without Regular Expressions	<b>147</b> 148150
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS Finding Patterns of Text Without Regular Expressions	147 148 150 150
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching	147 148 150 151 152
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching More Pattern Matching with Regular Expressions	147 148 150 151 152
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching More Pattern Matching with Regular Expressions Grouping with Parentheses	147148150151152152
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching More Pattern Matching with Regular Expressions Grouping with Parentheses Matching Multiple Groups with the Pipe	147
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching More Pattern Matching with Regular Expressions Grouping with Parentheses Matching Multiple Groups with the Pipe Optional Matching with the Question Mark	147
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching More Pattern Matching with Regular Expressions Grouping with Parentheses Matching Multiple Groups with the Pipe Optional Matching with the Question Mark Matching Zero or More with the Star.	147
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching More Pattern Matching with Regular Expressions Grouping with Parentheses Matching Multiple Groups with the Pipe Optional Matching with the Question Mark Matching Zero or More with the Star. Matching One or More with the Plus	147
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching More Pattern Matching with Regular Expressions Grouping with Parentheses Matching Multiple Groups with the Pipe Optional Matching with the Question Mark Matching Zero or More with the Star Matching One or More with the Plus Matching Specific Repetitions with Curly Brackets	147
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching More Pattern Matching with Regular Expressions Grouping with Parentheses Matching Multiple Groups with the Pipe Optional Matching with the Question Mark Matching Zero or More with the Star Matching One or More with the Plus Matching Specific Repetitions with Curly Brackets Greedy and Nongreedy Matching	147
PATTERN MATCHING WITH REGULAR EXPRESSIONS  Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching  More Pattern Matching with Regular Expressions Grouping with Parentheses. Matching Multiple Groups with the Pipe. Optional Matching with the Question Mark Matching Zero or More with the Star Matching One or More with the Plus Matching Specific Repetitions with Curly Brackets  Greedy and Nongreedy Matching The findall() Method	147
PATTERN MATCHING WITH REGULAR EXPRESSIONS  Finding Patterns of Text Without Regular Expressions  Finding Patterns of Text with Regular Expressions  Creating Regex Objects  Matching Regex Objects  Review of Regular Expression Matching  More Pattern Matching with Regular Expressions  Grouping with Parentheses.  Matching Multiple Groups with the Pipe.  Optional Matching with the Question Mark  Matching Zero or More with the Star.  Matching One or More with the Plus  Matching Specific Repetitions with Curly Brackets  Greedy and Nongreedy Matching  The findall() Method  Character Classes	147
PATTERN MATCHING WITH REGULAR EXPRESSIONS  Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching  More Pattern Matching with Regular Expressions Grouping with Parentheses. Matching Multiple Groups with the Pipe. Optional Matching with the Question Mark Matching Zero or More with the Star. Matching One or More with the Plus Matching Specific Repetitions with Curly Brackets  Greedy and Nongreedy Matching The findall() Method Character Classes  Making Your Own Character Classes	147
PATTERN MATCHING WITH REGULAR EXPRESSIONS  Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching  More Pattern Matching with Regular Expressions Grouping with Parentheses Matching Multiple Groups with the Pipe Optional Matching with the Question Mark Matching Zero or More with the Star Matching One or More with the Plus Matching Specific Repetitions with Curly Brackets  Greedy and Nongreedy Matching The findall() Method Character Classes Making Your Own Character Classes The Caret and Dollar Sign Characters	147
PATTERN MATCHING WITH REGULAR EXPRESSIONS  Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching More Pattern Matching with Regular Expressions Grouping with Parentheses. Matching Multiple Groups with the Pipe. Optional Matching with the Question Mark Matching Zero or More with the Star. Matching One or More with the Plus Matching Specific Repetitions with Curly Brackets  Greedy and Nongreedy Matching The findall() Method Character Classes Making Your Own Character Classes The Caret and Dollar Sign Characters The Wildcard Character	147
PATTERN MATCHING WITH REGULAR EXPRESSIONS  Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching More Pattern Matching with Regular Expressions Grouping with Parentheses Matching Multiple Groups with the Pipe Optional Matching with the Question Mark Matching Zero or More with the Star Matching One or More with the Plus Matching Specific Repetitions with Curly Brackets  Greedy and Nongreedy Matching The findall() Method Character Classes Making Your Own Character Classes The Caret and Dollar Sign Characters The Wildcard Character Matching Everything with Dot-Star	147
PATTERN MATCHING WITH REGULAR EXPRESSIONS  Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching More Pattern Matching with Regular Expressions Grouping with Parentheses Matching Multiple Groups with the Pipe. Optional Matching with the Question Mark Matching Zero or More with the Star Matching One or More with the Plus Matching Specific Repetitions with Curly Brackets  Greedy and Nongreedy Matching The findall() Method Character Classes Making Your Own Character Classes. The Caret and Dollar Sign Characters The Wildcard Character Matching Newlines with the Dot Character	147
PATTERN MATCHING WITH REGULAR EXPRESSIONS  Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching More Pattern Matching with Regular Expressions Grouping with Parentheses Matching Multiple Groups with the Pipe Optional Matching with the Question Mark Matching Zero or More with the Star Matching One or More with the Plus Matching Specific Repetitions with Curly Brackets  Greedy and Nongreedy Matching The findall() Method Character Classes Making Your Own Character Classes The Caret and Dollar Sign Characters The Wildcard Character Matching Everything with Dot-Star	147

Useful String Methods	127
The upper(), lower(), isupper(), and islower() String Methods	
The isX String Methods	129
The startswith() and endswith() String Methods	131
The join() and split() String Methods	
Justifying Text with rjust(), ljust(), and center()	
Removing Whitespace with strip(), rstrip(), and lstrip()	
Copying and Pasting Strings with the pyperclip Module	135
Project: Password Locker	
Step 1: Program Design and Data Structures	
Step 2: Handle Command Line Arguments	
Step 3: Copy the Right Password	
Project: Adding Bullets to Wiki Markup	
Step 1: Copy and Paste from the Clipboard	
Step 2: Separate the Lines of Text and Add the Star	
Step 3: Join the Modified Lines	
Summary	
Practice Questions	
Practice Project	
Table Printer	
PART II: AUTOMATING TASKS	145
PART II: AUTOMATING TASKS	145
PART II: AUTOMATING TASKS	145
7	145 147
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS	147
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS Finding Patterns of Text Without Regular Expressions	<b>147</b>
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS Finding Patterns of Text Without Regular Expressions	<b>147</b> 148 150
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS Finding Patterns of Text Without Regular Expressions	<b>147</b> 148150
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects	147 148 150 150
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching	147 148 150 151 152
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching More Pattern Matching with Regular Expressions	147 148 150 151 152
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching More Pattern Matching with Regular Expressions Grouping with Parentheses	147148150151152152
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching More Pattern Matching with Regular Expressions Grouping with Parentheses Matching Multiple Groups with the Pipe	147
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching More Pattern Matching with Regular Expressions Grouping with Parentheses Matching Multiple Groups with the Pipe Optional Matching with the Question Mark	147
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching More Pattern Matching with Regular Expressions Grouping with Parentheses Matching Multiple Groups with the Pipe Optional Matching with the Question Mark Matching Zero or More with the Star.	147
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching More Pattern Matching with Regular Expressions Grouping with Parentheses Matching Multiple Groups with the Pipe Optional Matching with the Question Mark Matching Zero or More with the Star. Matching One or More with the Plus	147
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching More Pattern Matching with Regular Expressions Grouping with Parentheses Matching Multiple Groups with the Pipe Optional Matching with the Question Mark Matching Zero or More with the Star Matching One or More with the Plus Matching Specific Repetitions with Curly Brackets	147
7 PATTERN MATCHING WITH REGULAR EXPRESSIONS Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching More Pattern Matching with Regular Expressions Grouping with Parentheses Matching Multiple Groups with the Pipe Optional Matching with the Question Mark Matching Zero or More with the Star Matching One or More with the Plus Matching Specific Repetitions with Curly Brackets Greedy and Nongreedy Matching	147
PATTERN MATCHING WITH REGULAR EXPRESSIONS  Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching  More Pattern Matching with Regular Expressions Grouping with Parentheses. Matching Multiple Groups with the Pipe. Optional Matching with the Question Mark Matching Zero or More with the Star Matching One or More with the Plus Matching Specific Repetitions with Curly Brackets  Greedy and Nongreedy Matching The findall() Method	147
PATTERN MATCHING WITH REGULAR EXPRESSIONS  Finding Patterns of Text Without Regular Expressions  Finding Patterns of Text with Regular Expressions  Creating Regex Objects  Matching Regex Objects  Review of Regular Expression Matching  More Pattern Matching with Regular Expressions  Grouping with Parentheses.  Matching Multiple Groups with the Pipe.  Optional Matching with the Question Mark  Matching Zero or More with the Star.  Matching One or More with the Plus  Matching Specific Repetitions with Curly Brackets  Greedy and Nongreedy Matching  The findall() Method  Character Classes	147
PATTERN MATCHING WITH REGULAR EXPRESSIONS  Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching  More Pattern Matching with Regular Expressions Grouping with Parentheses. Matching Multiple Groups with the Pipe. Optional Matching with the Question Mark Matching Zero or More with the Star. Matching One or More with the Plus Matching Specific Repetitions with Curly Brackets  Greedy and Nongreedy Matching The findall() Method Character Classes  Making Your Own Character Classes	147
PATTERN MATCHING WITH REGULAR EXPRESSIONS  Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching  More Pattern Matching with Regular Expressions Grouping with Parentheses Matching Multiple Groups with the Pipe Optional Matching with the Question Mark Matching Zero or More with the Star Matching One or More with the Plus Matching Specific Repetitions with Curly Brackets  Greedy and Nongreedy Matching The findall() Method Character Classes Making Your Own Character Classes The Caret and Dollar Sign Characters	147
PATTERN MATCHING WITH REGULAR EXPRESSIONS  Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching More Pattern Matching with Regular Expressions Grouping with Parentheses. Matching Multiple Groups with the Pipe. Optional Matching with the Question Mark Matching Zero or More with the Star. Matching One or More with the Plus Matching Specific Repetitions with Curly Brackets  Greedy and Nongreedy Matching The findall() Method Character Classes Making Your Own Character Classes The Caret and Dollar Sign Characters The Wildcard Character	147
PATTERN MATCHING WITH REGULAR EXPRESSIONS  Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching More Pattern Matching with Regular Expressions Grouping with Parentheses Matching Multiple Groups with the Pipe Optional Matching with the Question Mark Matching Zero or More with the Star Matching One or More with the Plus Matching Specific Repetitions with Curly Brackets  Greedy and Nongreedy Matching The findall() Method Character Classes Making Your Own Character Classes The Caret and Dollar Sign Characters The Wildcard Character Matching Everything with Dot-Star	147
PATTERN MATCHING WITH REGULAR EXPRESSIONS  Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching More Pattern Matching with Regular Expressions Grouping with Parentheses Matching Multiple Groups with the Pipe. Optional Matching with the Question Mark Matching Zero or More with the Star Matching One or More with the Plus Matching Specific Repetitions with Curly Brackets  Greedy and Nongreedy Matching The findall() Method Character Classes Making Your Own Character Classes. The Caret and Dollar Sign Characters The Wildcard Character Matching Newlines with the Dot Character	147
PATTERN MATCHING WITH REGULAR EXPRESSIONS  Finding Patterns of Text Without Regular Expressions Finding Patterns of Text with Regular Expressions Creating Regex Objects Matching Regex Objects Review of Regular Expression Matching More Pattern Matching with Regular Expressions Grouping with Parentheses Matching Multiple Groups with the Pipe Optional Matching with the Question Mark Matching Zero or More with the Star Matching One or More with the Plus Matching Specific Repetitions with Curly Brackets  Greedy and Nongreedy Matching The findall() Method Character Classes Making Your Own Character Classes The Caret and Dollar Sign Characters The Wildcard Character Matching Everything with Dot-Star	147

Substituting Strings with the sub() Method  Managing Complex Regexes  Combining re.IGNORECASE, re.DOTALL, and re.VERBOSE  Project: Phone Number and Email Address Extractor  Step 1: Create a Regex for Phone Numbers  Step 2: Create a Regex for Email Addresses  Step 3: Find All Matches in the Clipboard Text  Step 4: Join the Matches into a String for the Clipboard	164 165 166 166 167 168
Running the Program	169 169
Summary Practice Questions Practice Projects Strong Password Detection Regex Version of strip()	 169 170 171 171 171
8 READING AND WRITING FILES	173
	1 <i>7</i> 3
Files and File Paths	
The Current Working Directory	
Absolute vs. Relative Paths	
Creating New Folders with os.makedirs()	
The os.path Module	177
Handling Absolute and Relative Paths	177
Finding File Sizes and Folder Contents	
Checking Path Validity	180
The File Reading/Writing Process	180
Opening Files with the open() Function	181
Reading the Contents of Files	182 183
Writing to Files	184
Saving Variables with the pprint.pformat() Function	185
Project: Generating Random Quiz Files	
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	
Step 4: Write Content to the Quiz and Answer Key Files	 189
Project: Multiclipboard	
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	194 194
Extending the Multiclipboard	194
Mad Libs	195
Regex Search	195
•	