Python Challenge!

There's no substitute for practice when it comes to learning a new skill!

Python syntax is simple to learn, but becoming an expert in writing programs to solve different kinds of problems takes a bit longer and requires patience. That's why this book provides a gamified approach with a short **explanation** of each new statement or technique, followed by one or more **examples** and then loads of practice **challenges**.

- **Helpful programming tips**
- **Coded solutions with answers given in the back of the book**
- **Starred challenges – Partially written programs for you to complete**

Some of the challenges will take you only a minute or two, using the Python Interactive window to try out new statements and get immediate results. As you get further into the book, you will be challenged to write programs to perform different kinds of tasks - for example to find the results of a calculation, write a program for a simplified cash machine, sort a list of items into alphabetical order, or to record data in a text file to be read, formatted, and printed.

The programming solutions to some challenges have been helpfully simplified for an inexperienced programmer to modify rather than to write from scratch. This builds your confidence in problem-solving. That's why **35 challenges consist of partially written programs for you to complete**.

You'll find all the solutions to the Python programs in a free downloadable pack from www.clearrevise.com or www.pgonline.co.uk.

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Python Challenge!

Learn to program **fast** in:

155 Challenges
54 Examples
85 Pages

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CONTENTS AND CHECKLIST

Start here!
Just follow the line

INTRODUCTION

Learn (through explanations and examples)

- Each new concept, Python statement or programming technique is carefully explained and one or more examples given. All the example programs are given in the **Examples** folder of the free **Python programs** pack (see below), and you can copy, run and edit them if you wish.

Do (with more than 150 challenges)

As each new statement or programming technique is introduced, several practice challenges are given for you to use newly learned skills in writing, editing and running programs.

The challenges are of three different types:

- Short challenges that ask you to write a Python statement or answer a question. You will find the answers to these challenges in the back of the book.
- Challenges that ask you to write and test a program. For these, you need to create your own folder to write, save, edit and run your programs. You could call the folder, for example, **My Python solutions**. You will find suggested solutions to all these challenges in a folder called **Challenge solutions**. This is a subfolder of the **Python programs** folder.
- Challenges that consist of a partially written program for you to complete. These are all identified with a star and are held in a subfolder of the **Python programs** folder called **Starred challenges (incomplete)**. You should download this entire folder to your own computer. When you are ready to do one of these programming challenges, copy the incomplete program to your own folder and rename it, e.g. **Level 1 Challenge 8 (*your initials*).py**. Then complete this program and test it.

  Completed solutions to these partially written programs are also held in the **Challenge solutions** folder. If you get stuck, you can look at the suggested solution, and compare it with yours. There are often several ways of writing correct Python statements to solve the problem, so don't worry if your solution is not identical to the one given. Just make sure yours works correctly!

Review (by selecting topics, regular and starred challenges)

As you work through the book, and the challenges become longer, you will be constantly revisiting statements and techniques you have already covered, using them in different ways. And, if you have already done a Python course and just need to revise what you have already learned, this book is ideal.

! Before you start

Download the free Python programs pack from www.clearrevise.com or www.pgonline.co.uk.

There is a quick reference guide to all of the basic Python syntax at the back of this book. Download and run **syntaxsummary.py** from the **Python programs** folder.

LEVEL 1

GETTING STARTED

Python is one of the most popular text-based programming languages, widely used in schools and colleges, and also in web development, game development, artificial intelligence, business, computer-aided design and many more applications.

The Python language

Python has two modes of entering and running programs. In **interactive mode**, you can type instructions and Python will respond immediately. This is very useful for trying out statements that you are not sure about, and is a good place to start.

Download Python from **www.python.org/downloads**

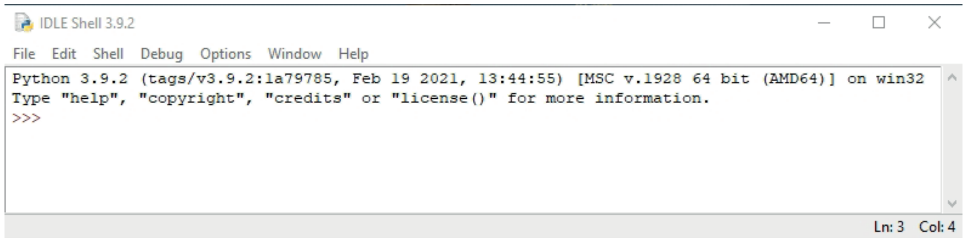
Tip

You cannot save a program that you have written in interactive mode. This has to be done in **script mode**, used in the other levels (or chapters) of this book.

An interactive session

To begin an interactive session, open **Python 3**. On a PC, you can use the **Search** box in the bottom left corner of your screen, or the **Start** menu. Then select the version installed on your computer (e.g. Python 3.9). Load Python's **integrated development environment**, named **IDLE**.

You will see a screen similar to the one below:



```
Python 3.9.2 (tags/v3.9.2:1a79785, Feb 19 2021, 13:44:55) [MSC v.1928 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
```

In this window, which is called the **Python Shell** or **Interactive window**, you can type commands at the `>>>` prompt.

Example 1

```
>>> print("Hello world")
```

The Python interpreter responds to your command and you will see `Hello world` appear on the next line, followed by a new line with the prompt `>>>`.

```
Hello world
>>>
```

Output statement (print)

Use the Python Shell (Interactive mode) for Challenges 1–5.

You can use single or double quotes in the `print` statement. If you need speech marks or an apostrophe inside the text to be printed, use single quotes around the whole text to be printed, and double quotes inside it, or vice versa:

Tip

If you have a long line of code, you can split it over two lines by typing a backslash (\) and pressing Enter. Then continue the statement on the next line.

Example 2

```
>>> print('The guide told us "Stay very still! " ')
The guide told us "Stay very still! "
```

Example 3

```
>>> print("A gorilla's diet is mainly vegetarian.\
They feed mainly on stems, bamboo shoots and fruits.")
>>>
```

When you press **Enter**, the computer will print as much as it can on the first line, depending on the size of your window, and continue on the next line:

```
>>> print("A gorilla's diet is mainly vegetarian.\
They feed mainly on stems, bamboo shoots and fruits.")
A gorilla's diet is mainly vegetarian.They feed mainly on st
ems, bamboo shoots and fruits.
>>>
```

Challenge 1

Write a Python statement to display the line:

```
Gorillas are the largest living primates.
```

Challenge 2

Write a Python `print` statement, split over two lines, to print the following output on one line. Use the tip above to help you:

```
The scientific name for the Western Lowland
gorilla is "Gorilla gorilla gorilla"
```

Assignment statements

An assignment statement always contains an = sign, but it is not an equation. It means "Take whatever is on the right-hand side of the = sign and put it into the variable named on the left-hand side of the = sign."
Simple assignment statements look like this:

```
age = 17
distanceTravelled = 35.6
street = "Granville Street"
over18 = False
winner = True
count = count + 1
```

The last statement adds 1 to whatever was in the variable `count` and puts the result back in `count`.

Challenge 22

Enter the following statements in the Python Shell (Interactive window).

```
cabFare = 4.50
flight = 91.25
train = 11.80
total = cabFare + flight + train
print("Total travel expenses =",total)
```

This should print:

```
Total travel expenses = 107.55
```

Converting from strings to numbers

In Python, all data items input by the user are treated as **string** variables. Numbers input by the user have to be converted to either integers or floating point numbers before they can be used in calculations.

Function	Description	Example	Returns
float(x)	Converts a string to a floating point value	float("4.65")	4.65
int(x)	Converts a string to an integer	int("3")	3
str(x)	Converts a number x to a string value	str(5.0)	'5.0'

To convert a string to an integer, use the `int()` function.
To convert a string to a floating point number, use the `float()` function.

Inputting numerical data

Example 3

```
#Program name: Level 2 Example 3 Add and multiply two integers
x = int(input("Enter the first integer: "))
y = int(input("Enter the second integer: "))
sumXY = x + y
product = x * y
print("Sum =", sumXY)
print("Product =", product)
```

Example 4

Below is a Python program to allow the user to enter costs of travel, using the same values as in Challenge 22. The statements appear as follows:

```
#Program name: Level 2 Example 4 Cost of travel
cabFare = input("Enter cost of the cab fare: ")
flight = input("Enter cost of your flight: ")
train = input("Enter cost of any train fare: ")
total = cabFare + flight + train
print("Total travel expenses: ",total)
```

Run and test the program using 4.50, 91.25 and 11.80 as input values. The output appears as:

```
Total travel expenses: 4.5091.2511.80
```

What has happened? All the data has been entered as strings and concatenated (joined together) in the `print` statement. All the costs need to be converted to floating point values.

Challenge 50

Use the following test data to test your program. (Challenge 49.)

Test	Model	dB level	Expected result	Actual result
1	A	93	"Failed minimum limit"	
2	B	110	"Failed. Requires adjustment or reclassification as Model A"	
3	C	110	"Failed. Requires adjustment or reclassification"	
4	C	126	"Passed"	
5				
6				
7				

Challenge 51

Make up three more tests to test different aspects of the program. Your tests should include valid and invalid data, boundary data and normal data.

Challenge 65

Write a program to enter the names and times in seconds of runners participating in 100m race heats. The program should prompt for a name, then prompt for their time, e.g.

```
Enter time in seconds for King, R:
```

The end of data is signalled by entering `xxx` for the runner's name.

Print the average time, in seconds, of all the runners.

Challenge 66 ★

Load **Challenge 66 Tiles required to cover given area incomplete** from the **Starred challenges (incomplete)** folder.

The program asks the user to enter the size in m^2 of an area that needs tiling. The user then selects the size of tiles they want from a range of sizes given in cm. The program tells them how many tiles they will need. (Ten percent is added to the calculated number to allow for tiles that need to be cut, and this number is rounded down to the nearest whole number.)

Copy and complete the program and save it in your own folder.

Test your completed program by entering 20 cm for tile length, 12 cm for tile width and 2.4 m^2 for area to be covered. The integer number of tiles required, including the 10% extra), is 110.

Challenge 67 ★

Load **Challenge 67 Double a number repeatedly incomplete** from the **Starred challenges (incomplete)** folder.

The program asks the user to enter a number between 1 and 10. If the number is not in this range, keep printing a warning message and asking the user to re-enter the number. Then keep doubling this number until the result is 100,000 or more. Print the final result and the number of times the number was doubled.

Challenge 68

Amend the program **Challenge 68 Double a number repeatedly completed** so that the user can enter the final target. Include validation to ensure the target entered by the user is between 20 and 100,000. Also include a `print` statement so that the number, and number of times doubled, is printed each time it is doubled.

LEVEL 5

ARRAYS AND LISTS

5

An **array** is a data structure that stores values of the same data type, such as integers, floating point numbers, characters or strings.

An array is a common data structure in languages such as Visual Basic and Java, but a **list** is a much more common data structure in Python. In Python, a list is used instead of an array.

A Python **list** can store values of different data types, for example:

```
list1 = ["Alan", "Johnson", 27, "M", "Blonde"]
```

Working with lists

You can print the contents of a list with a single `print` statement.

Try this in the Python Shell:

```
>>> list1 = ["Alan", "Johnson", 27, "M", "Blonde"]
>>> print(list1)
['Alan', 'Johnson', 27, 'M', 'Blonde']
```

Initialising a variable or a list provides a starting value. You can initialise a list like this:

```
planet = ["Jupiter", "Saturn", "Uranus", "Neptune", "Earth", "Venus"]
```

Items in a list may be referred to using an **index**. The first item has an index of 0.

```
print(planet[0]) #will print Jupiter
```

Example 1

Print all the items in the `planet` list, with each item on a separate line.

```
#Program name: Level 5 Example 1 List of planets

planet = ["Mercury", "Venus", "Earth", "Mars", "Jupiter", "Saturn"]
n = len(planet) #sets n equal to number of items in the list
for index in range(n):
    print(planet[index])
```

Challenge 71

Write a single statement to print the list of planets.

List methods and functions

(See Page 45 for comparison of methods and functions.)

Method / Function	Description	Example
`list.append(item)`	Adds a new item to the end of the list	`planet.append("Uranus")`
`del <list>[<index>]`	Removes the item at index from the list	`del planet[3]`
`list.insert(index,item)`	Inserts an item just before an existing one at index	`planet.insert(3,"Pluto")`

`<item> = list()`
`<item> = []`
	Two methods of creating an empty list structure	`planet = list()`
		`planet = []`

Challenge 72

Write a program to initialise the list of planets:

```
planet = ["Mercury", "Venus", "Earth", "Mars", "Jupiter", "Saturn"]
```

Use the **`list.append()`** method to append Uranus and Neptune to the end of list.

Print the list in the format:

```
['Mercury', 'Venus', 'Earth', 'Mars', 'Jupiter', 'Saturn', 'Uranus', 'Neptune']
```

Challenge 73

Write a program to initialise the list:

```
["Mercury", "Venus", "Mars", "Jupiter", "Saturn"]
```

Use a list method to insert "Earth" between "Venus" and "Mars".

Print the amended list.

Challenge 74

Write a program to initialise and print the list of planets:

```
planet = ["Mercury", "Venus", "Earth", "Mars",
"Jupiter", "Saturn"]
```

Then print the list with each planet on a separate line starting with Saturn, and ending with Mercury.

Example 7

The program below generates 20 random floating point numbers between 0 and 1. Using these numbers, random numbers between 0 and 200, and between 50 and 250 are generated. The three sets of numbers are printed in neat columns.

```
#Program name: Level 6 Example 7 Formatting printed columns
import random

for index in range (20):
   num1 = random.random()      #returns a random number between 0 and 1
   num2 = num1 * 200           #returns a random number between 0 and 200
   num3 = num1 * 200 + 50      #returns a random number between 50 and 250

   #print num1 to 4 decimal places,
   #num2 to 2 decimal places, num3 to 1 decimal place

   #each number occupies 20 spaces and is right aligned
   print("{:>20.4f}{:>20.2f}{:>20.1f}".format(num1,num2,num3))
```

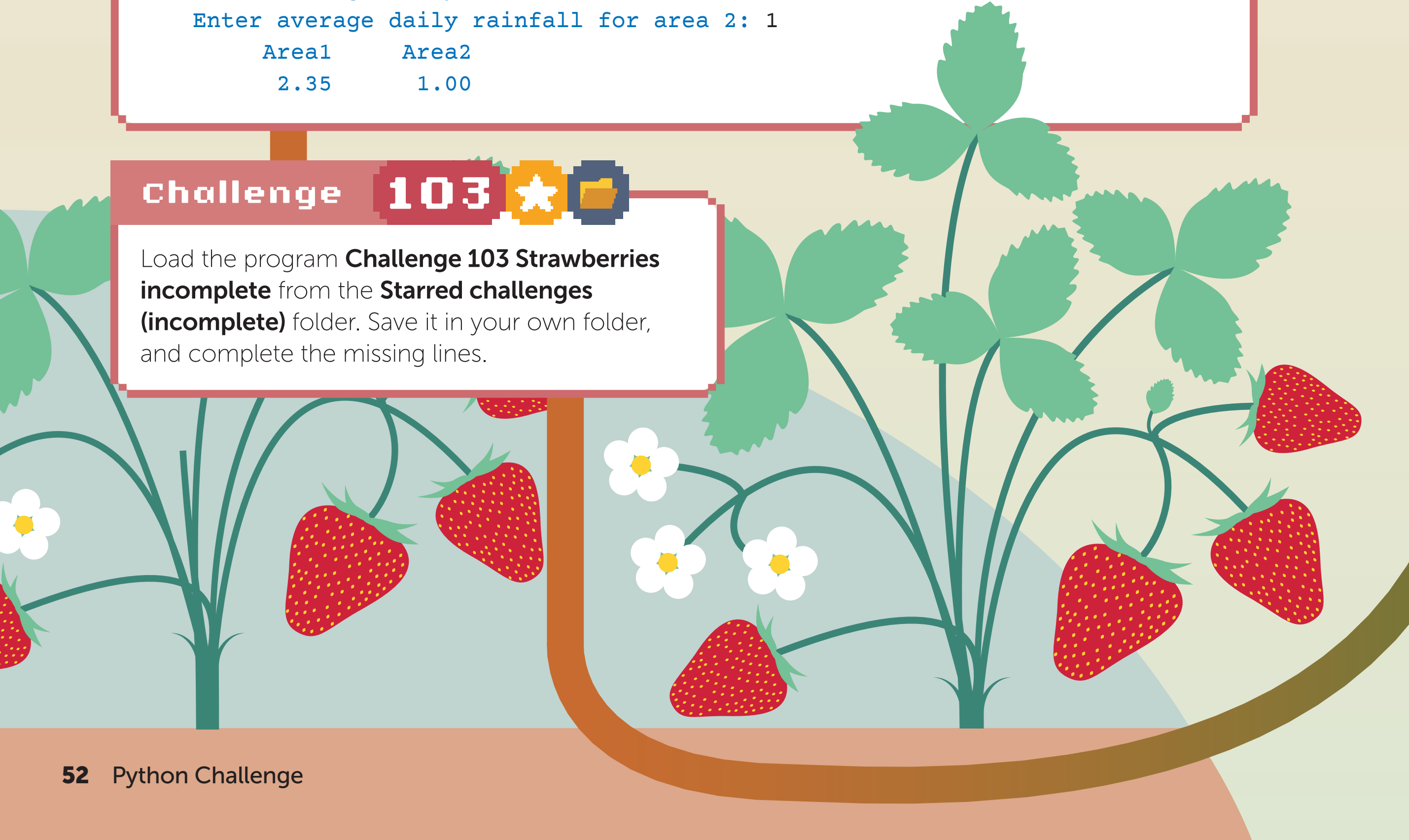
Challenge 102

Write a program that allows a user to enter two numbers `area1` and `area2`, e.g. 2.347 and 1, representing average daily rainfall in two different areas. Print a heading, and print the numbers with two decimal places on one line, each in a 10-character space.

```
Enter average daily rainfall for area 1: 2.347
Enter average daily rainfall for area 2: 1
     Area1     Area2
      2.35      1.00
```

Challenge 103

Load the program **Challenge 103 Strawberries incomplete** from the **Starred challenges (incomplete)** folder. Save it in your own folder, and complete the missing lines.



Challenge 121

Copy the program given in Example 1. Then change the pen colour to green, pen width to 10 and move to a new start point with coordinates (–100, 200). Draw a hexagon with sides of length 75.

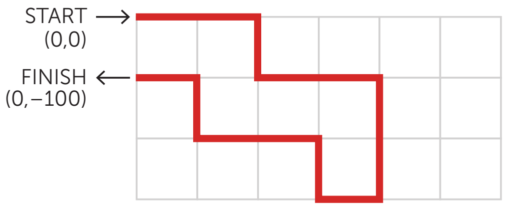
Challenge 122

Write a program which sets the pen width to 3 and pen colour to red. Hide the turtle and draw a pentagon with sides of length 100 pixels, starting in the middle of the screen.

Challenge 123

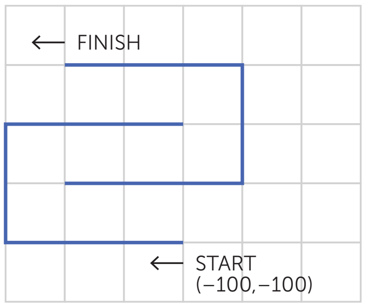
Complete the program **Challenge 123 Draw red shape incomplete** which sets the pen colour to red, the width to 10, the turtle to a turtle shape and the drawing speed to “slow”. Draw the following shape on the screen, starting at coordinates (0,0) in the middle of the screen.

(Each square in the grid is 100 × 100 pixels).



Challenge 124

Write a program which sets the pen colour to blue, the width to 5. Draw the following shape on the screen, starting at coordinates (–100, –100). (Each square in the drawing is 100 × 100 pixels).



Example 2

```
#Program name: Level 9 Example 2 Bubble sort (fish)

fish = ["parrotfish", "grouper", "boxfish", "damselfish",\
       "snapper", "ray"]

#get number of items in the list
numItems = len(fish)
passNumber = numItems - 1
swapMade = True
while passNumber > 0 and swapMade:
    swapMade = False
    for j in range(passNumber):
        if fish[j] > fish[j + 1]:
            temp = fish[j]
            fish[j] = fish[j + 1]
            fish[j + 1] = temp
            swapMade = True
    passNumber = passNumber - 1
print("\nSorted list:\n",fish)
```

Challenge 133

How many passes will be required to sort the following list?

parrotfish, grouper, boxfish, damselfish, snapper, ray

Challenge 134

Load program **Challenge 134 Bubble sort incomplete** from the **Starred challenges (incomplete)** folder. Amend it so that it prints the state of the list and the value of the Boolean variable `swapMade` after each pass.

Explain why in this algorithm, the last pass does not always change the list.

LEVEL 10

READING AND WRITING TEXT FILES

10

The programs that you have written so far sometimes use data entered by the user. When the program ends, the data is lost.

Data often needs to be stored on a permanent storage device such as hard disk or SSD, so that it can be read and processed as often as required.

Most real-life applications will store data in a database, from which information can be easily retrieved using queries written in a language called SQL (Structured Query Language).

In this level you will practise reading from and writing to **text files**. A text file can be created in Python (see Level 10 Example 1a in the Examples folder), or even in Notepad. Each line in the file is a separate **record**, usually consisting of several **fields** of different data types. There are several different ways, in Python, to read records sequentially from a text file.

Reading a text file using `for <line> in <fileid>`

Example 1

A text file has been created to hold the names, genders and ages of seven students going on a outdoor survival weekend.

The program below opens the text file, reads all the records, prints them and closes the file.

```
#Program name: Level 10 Example 1 print text file
#reads records from a file named students1.txt and prints each record
studentFile = open("students1.txt","r")
for studentRec in studentFile:
    print(studentRec)
studentFile.close()
```

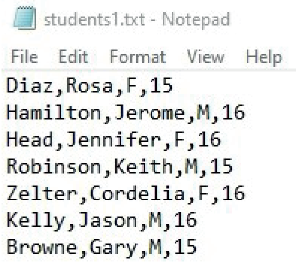
When this program is executed, the output is double-spaced:

```
Diaz,Rosa,F,15

Hamilton,Jerome,M,16

Head,Jennifer,F,16

(etc.)
```



```
Diaz,Rosa,F,15
Hamilton,Jerome,M,16
Head,Jennifer,F,16
Robinson,Keith,M,15
Zelter,Cordelia,F,16
Kelly,Jason,M,16
Browne,Gary,M,15
```

ANSWERS

Note: All programmed solutions are in subfolders of the Python programs folder. Download free from clearrevise.com.

Level 1

Challenge 1:

```
print("Gorillas are the largest living primates.")
```

Challenge 2:

```
print('The scientific name for the Western Lowland \
gorilla is "Gorilla gorilla gorilla"')
```

Challenge 3:

```
print("Don't worry.\nBe happy")
```

Challenge 5: Missing quote at end of line. The 'EOL while scanning string literal message' means the debugger reached the End Of Line while scanning the text string and couldn't find an end quote.
firstName = input("What is your name?)

Challenge 7: `animal1`, `animal2` or `animal3` (or alternative variable names that you used)

Challenge 9: All valid except (c) 1stClass and (f) A–1

Challenge 10:

```
10 5
```

Challenge 11:

```
Fred Tom Fred
```

Challenge 13: (a) Max lives could be a constant in a computer game. (b) Lives remaining will vary during a computer game. (c) Population can vary over time. (d) The unit of gravity on earth is a constant.

Challenge 14:

```
>>> firstname = input("Enter firstname: ")
Enter firstname: Jo
>>> surname = input("Enter surname: ")
Enter surname: Brown
>>> print(surname,firstname)
Brown Jo
>>>
```

Challenge 16: (a) Missing quote at the end of a string. (`EOL` stands for End Of Line.)
(b) Incorrectly spelt or undefined variable name.

Level 2

Challenge 18:

```
print("13685 divided by 27 =",13687//27, " remainder ",
13687%27)
```

Result: 13685 divided by 27 = 506 remainder 23

Challenge 19:

```
mondayMiles = 20.0
tuesdayMiles = 23.75

print("Total miles travelled on Monday and Tuesday =",\
mondayMiles + tuesdayMiles)
```

Challenge 20:

```
print((7*3) + (16/5))
```

Challenge 21:

```
print("2 to the power 10 =",2**10)
```

Challenge 24: (a) integer (b) string (c) float

Challenge 27: Fahrenheit and Celsius temperatures are the same at –40

Challenge 28:

```
>>> num1 = 24
>>> num2 = 3
>>> print("The sum of " + str(num1) + " and " + str(num2) + " is " + str(num1 +
    num2))
The sum of 24 and 3 is 27
```

Challenge 30:
```
x = input("Enter value for x : ")
y = input("Enter value for y : ")
temp = x
x = y
y = temp
print("Swapped values: x =",x, "  y =", y)
```

Challenge 33:
```
20
```

Level 3

Challenge 34:
```
>>> 10 * 7 == 70
True
```

Challenge 35:
```
>>> "John" != "JOHN"
True
```

Challenge 36:
```
>>> (6 <= 2*4) and (28 <= 7*4)
True
```

Challenge 37:
```
>>> (x < 0) and (y < 0)
```

Challenge 38:
```
>>> (x == 0) or (b == 0)
```

Challenge 39:
```
>>> a = 24/8
>>> b = 24 + 8
>>> print(a==b)
False
```

Challenge 40:
```
>>> print(237//17 == 237/17)
False
```

Challenge 41:
```
>>> print(10 == 5*2 and 45 != 9*5)
False
```

Challenge 42:
```
>>> print(6*3 >= 9*2 or 30//7 == 2)
True
```

Challenge 51: For example, use test data such as:
A, x (Invalid data, expected result – runtime error)
B, 109 (Boundary data, expected result "Failed. Requires adjustment." message)
D, 120 (invalid model data, valid decibel data. Expected result error message "Model must be A, B or C. No result given.")

Level 4

Challenge 56: These are some sample tests that you could use:

Test	a	b	Expected result	Actual result
1	3	26	13, 26	
2	3	27	13, 26	
3	13	39	13, 39	
4	12	45	13, 39	
5	–30	0	–29, –13, 0	
6	–40	–13	–39, –26, –13	
7	27	13	nothing printed	

Challenge 64:
```
Enter -1 when no more data
Enter number of lengths on day 1: ( etc)
```

Level 5

Challenge 71: `print(planet)`

Challenge 76: `totals = [0] * 100`

Challenge 82: `booking[1][2] = 96`

Level 6

Challenge 87: `20`

Challenge 88: `7` The "escape sequence" `\n` is counted as one character..

Challenge 89:

```
name = input("Enter full name")
print(len(name))
print(name[0])
print(name[len(name) - 1])
```

Challenge 96: `response.upper() == "Y"`

Challenge 98: It converts the characters entered by the user to uppercase. This means that the user can enter "aa", "AA", "Aa", "ba", etc. for the flight number to be accepted.

Challenge 100: `myStringUppercase = mystring.upper()` is incorrect. It should be:
`myStringUppercase = myString.upper()` (Note the 'S' in `myString`.)

Challenge 101: Test data1: powerGenerated = abc (non-numeric value)
Test data 2: powerGenerated = 75, daysLowWind = 7 (division by zero)

Level 7

Challenge 104: `price2 = round(price1,2)` assigns 5.33 to `price2`

Challenge 105:

```
print(ord("A"))
print(chr(68))
```

prints D

Challenge 106:

```
for n in range(0,100,3):
  print(n)
```

Challenge 107:

```
import math
area = 2 * math.pi*5.8
print(round(area,2))
```

(prints 36.44)

Challenge 108:

```
import math
print(math.floor(38.0))
print(math.floor(53.9))
```

Challenge 116: Python will report a runtime error when it reaches the line
`secs = int(time[4:6])`

Challenge 117: (a) Global variables: `title` (defined as `global` in the function) `heading` (declared in the main program)
(b) Local variables `face`, `n`, `dieroll`, `dieface`
(c) A runtime error will occur as the local variable `face` is only recognised within the function.

Challenge 118: `seconds = random.random()* 20`

Level 8

Challenge 129: `drawPolygon(100,3)`

Level 9

Challenge 133: Two passes, and an extra pass to verify that no swaps were made in the previous pass

Challenge 134: The Boolean variable `swapMade` is set to False if no swaps are made during a pass. The `while` loop then terminates.

Challenge 135: 5 passes though the list of 6 items

Challenge 136:

```
myList = [3,7,1,9,4,6]
myListLength = len(myList)
temp = myList[2]
```

Challenge 138: `print(searchItem, "was item", index + 1, "in the list")`

Challenge 139: (a) 500 (b) 1000

Challenge 140: Ken Oliver Peter

Challenge 141: (a) `midpoint = 5` (b) `alist[midpoint] = ”Jas”`

Challenge 142: `print` statement executed four times within loop.

Final `print` statement:

```
Item is not in the list
```

Challenge 145: Challenge 145 binary search with errors (in Starred Challenges (incomplete) folder).

Syntax errors:

`print("loop executed)` missing quote mark

`else` missing colon

Logic errors:

`midpoint = (firstIndex + lastIndex) / 2` should be int((first + last) / 2)

`lastIndex = len(aList)` should be last = len(aList – 1)

Runtime errors:

`print("List of names to be searched:",aList[12])`

list index out of range

`print("Found at position" + index + "in….`

should be str(index) or use comma instead of +

Challenge 146: The last test results in a runtime error

```
if aList[midpoint] == searchItem:
IndexError: list index out of range
```

This is because `lastindex` should be initialised as `last = len(aList) - 1`

Challenge 147: Actual outcome should be as expected for all tests.

You could add tests to test the lower boundary data (1), test outside the top boundary (101), and test an invalid input (not <, =, or >).

Level 10

Challenge 150:

```
Output will be:
Rosa Diaz is 15
 years old
Jerome Hamilton is 16
 years old
```

etc.

PYTHON SYNTAX GUIDE

Help Download **syntaxsummary.py** from the Python programs folder available from **www.ClearRevise.com** for a Python version of this quick reference guide.

Input statement

```
name = input("Enter name: ")
visitors = int(input("How many visitors? "))
cost = float(input("Enter cost per person: "))
totalCost = visitors * cost
```

Output statement

```
print("Total cost:",totalCost)
```

or use concatenation to join two strings:

```
print("TotalCost " + str(totalCost))
```

`"end"` parameter prevents automatic newline

```
print("Total cost ",end="")
print(totalCost)
```

newline character `"\n"` causes a skip to a new line

Arithmetic operators

		Result
addition	a = 15 + 2	a = 17
subtraction	b = 15 - 2	b = 13
multiplication	c = 15 * 2	c = 30
division	d = 15 / 2	d = 7.5
exponentiation	e = 5 ** 2	e = 25
integer division (div)	f = 15 // 2	f = 7
remainder (mod)	g = 15 % 2	g = 1

Logical and Boolean operators

		Examples (a = 3, b = 5)	
less than	<	a < b	True
greater than	>	a > b	False
less than or equal	<=	a <= b	True
greater than or equal	>=	a >= b	False
equal	==	a == b	False
not equal	!=	a != b	True
logical and	and	a == b and b == 5	False
logical or	or	a == b or b == 5	True
logical not	not	not(a == b)	True

Definite iteration

print numbers 0 to 5:

```
for n in range(6):
    print(n)
```

print numbers 5 to 8:

```
for n in range(5,9):
    print(n)
```

print every third number between 1 and 10:

```
for n in range(1,11,3):
    print(n)
```

print every third number counting down from 99 to 90, counting down

```
for n in range(99,89,-3):
    print(n)
```

Indefinite iteration

```
daysRemaining = 6
while daysRemaining > 0:
    daysRemaining = daysRemaining - 1
    print("Days to Christmas",\
          daysRemaining)
print("Happy Christmas!")
```

Selection

if statement

```
if (age < 18):
    print("Under age")
```

if...else statement

```
if (score >= 50):
    print("Pass")
else:
    print("Fail")
```

if...elif...else statement

```
if (score >= 80):
    print("Well done")
    print("Distinction")
elif (score >= 70):
    print("Merit")
elif (score >= 50):
    print("Pass")
else:
    print("Fail")
```

Strings

```
myString = "This is a string"
len(mystring)  evaluates to 16 (characters in the string)
```

Iterating through a string

```
for nchar in myString:
    print(nchar)
```

Two useful string methods

```
myStringUCase = myString.upper()
myStringLCase = myString.lower()
```

Slicing strings

e.g. to isolate characters 5 to 8 of myString:

```
chars5to8 = myString[5:8]
```

Turtle methods

Import the turtle module before using any turtle statement:

```
import turtle
```

`turtle.setpos(-300,0)`	positions the turtle at (-300,0)
`turtle.home()`	positions turtle at (0,0)
`turtle.forward(100)`	
`turtle.right(90)`	turns through 90 degrees clockwise
`turtle.left(30)`	turns through 30 degrees anti-clockwise
`turtle.penup()`	lifts the pen
`turtle.pendown()`	puts the pen down
`turtle.pensize(10)`	sets the pensize
`turtle.pencolor("red")`	sets the pen colour

Lists

```
myList = ["Bob","Mandy","Fred","Jo","Keira"]
```

`print(myList[0])`	prints Bob
`print(myList)`	prints the whole list
`print(len(myList))`	prints 5 (the number of items in the list)
`aList = [] * 100`	initialises an empty list of 100 items

Two-dimensional lists

A quiz has 4 rounds and 3 teams
Results are entered in a 2-D list.
Row indices go from 0 to 2 (teams)
Column indices go from 0 to 3 (rounds)

```
quizResults =  [[ 5, 7, 9, 4],   (row 0)
                [12,14,10,18],   (row 1)
                [27,21,23,20]]   (row 2)
```

`print(quizResults[1][3])` prints 18, the result in second row and fourth column

Subroutines

Function (returns a value)

```
def myFunction(a,b):
    x = a + b
    return(x)
```

To call the function:

```
    sum = myFunction(3,4)
```

Procedure (does not return a value)

```
    def myproc():
```

or pass parameters to the procedure:

```
    def greet(greeting,name):
    print(greeting, name)
```

To call the procedure:

```
    greet("Hello","Jane")
```

Random module

`import random` imports the module
`random.randint(a,b)` returns a random integer X so that a <= X <= b
`random.random()` returns value from 0.0-1.0

Text files

Opening a text file

A text file can be opened for reading, writing or appending data

`gameFile = open("gamescore.txt","r")` opens the file for reading

Set the final parameter to "w" to write a new file or overwrite an existing one

Set the final parameter to "a" to append data or create a new file if no file can be found

Closing a text file

```
    gameFile.close()
```

Reading a text file

`gameFile.read()` reads the entire file
`gameRec = gameFile.readline()` reads one line of a text file. This returns an empty string "" on reaching the end of file

Writing or appending a line to a text file

```
    gameFile.write(field1 + field2 +
    ...
    + "\n" )
```

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