IRIS 2022 Seismology Skill Building Workshop OSL

Quiz navigation

1 2 3 4 5 6
7 8 9 10 11 12
13 14 15 16 17 18
19 20 21 22 23 24
25 26 27 28 29 30
31 32 33 34 35 36
37 38 39

Finish review

Started on	Monday, August 8, 2022, 5:20 PM
State	Finished
Completed on	Tuesday, August 9, 2022, 8:16 AM
Time taken	14 hours 56 mins
Marks	34.04/39.00
Grade	**87.29** out of 100.00

Question 1

Correct

1.00 points out of 1.00

Flag question

In this activity, you are going to start our introduction to python by using it to help us with aftershock decay rates. Login to the OSL and create a folder named **python** and then a folder inside of it named **aftershocks** and then move into this directory. What is the correct order of commands below to create and then enter this **aftershocks** directory?

mkdir python	1 ✓
cd aftershocks	4 ✓
mkdir aftershocks	3 ✓
cd ~/python	2 ✓

Check

Please make sure you run these commands now to create, check, and then enter this **aftershocks** directory.

Correct
Marks for this submission: 1.00/1.00.

Question 2

Correct

1.00 points out of 1.00

Flag question

Since this is our first tutorial on Python, we will start with the basics. Python is a popular programming language so there are many online resources for learning how to use it. I am going to rely on a few of them to help get you up to speed. In essence, I would like you to learn how to use the online resources to learn how to accomplish simple research tasks - this is a very common approach in scientific programming! It would be great if you could spend the time to take a full course on Python, but scientists often have to learn coding as they go, so this tutorial will mimic that approach.

Let's begin with opening python from the command line. You can use Python in two ways:
1) from a Python command prompt where you enter commands one at a time and receive any output immediately or
2) by sending a program script file to the interpreter to run a series of commands in succession.

We will start briefly with option 1, but quickly move to option 2 since we have been creating scripts in the c-shell on linux already and programs are much more common in science. Type `python` to start the Python interpreter. Which version of Python is running when you type this command?

Select one:

- a. 3
- b. 2
- c. 3.10.4 ✓
- d. 3.5.2
- e. 2.7.5
- f. 3.7.1

Check

Correct
Marks for this submission: 1.00/1.00.

Question 3

Correct

1.00 points out of 1.00

Flag question

Since almost all computer programming tutorials start with printing the text "Hello, world" we might as well start with it too. Go ahead and type the following at the Python command prompt:

```
print ("Hello, world")
```

What does it produce?

Select one:

- a. ("Hello, world")
- b. "Hello, world"
- c. Hello, world ✓
- d. SyntaxError: Missing parentheses in call to 'print'.
- e. (Hello, world)

Check

Correct
Marks for this submission: 1.00/1.00.

Question 4

Correct

1.00 points out of 1.00

Flag question

To make sure you've got this, which of the following commands would successfully print "I got this!" in Python?

Select one:

- a. print (I got this!)
- b. print "I got this!"
- c. print ("I got this!") ✓
- d. print "(I got this!)"

Check

Correct
Marks for this submission: 1.00/1.00.

Question 5

Correct

0.67 points out of 1.00

Flag question

The other thing useful about typing commands directly into the Python command line is performing calculations. You can type mathematical equations using common math symbols, and I would ask you to take a look at these pages to learn about this quickly:

https://www.learnpython.org/en/Basic_Operators

https://docs.python.org/3/tutorial/introduction.html#using-python-as-a-calculator

If we wanted to calculate how long it would take a seismic wave to travel straight through the Earth from one side to the other at an average speed of 10.5 km/s, which of the following calculations would accomplish this?

Select one:

- a. 6371 * 2 / 10.5 ✓ Correct! Go ahead and type this into the command line.
- b. 6371 * 2 * 10.5
- c. 10.5 / 6371
- d. 10.5 / (6371 * 2)
- e. 6371 / 10.5
- f. 6371 * 10.5

Check

Correct
Marks for this submission: 1.00/1.00. Accounting for previous tries, this gives **0.67/1.00**.

Question 6

Correct

1.00 points out of 1.00

Flag question

Let's do another calculation before moving on. The energy from an earthquake (E) is typically thought to be related to the magnitude (M) by the following equation:

$E = 10^{(1.5 * M + 4.8)}$

Which of the following would calculate the energy release from a magnitude 5 earthquake in Python?

Select one:

- a. 10 ** 1.5 * 5 + 4.8
- b. 10 pow (1.5 * 5 + 4.8)
- c. 10 * pow (1.5 * 5 + 4.8)
- d. 10 ** (1.5 * 5 + 4.8) ✓
- e. 10 ^ (1.5 * 5 + 4.8)

Check

Correct
Marks for this submission: 1.00/1.00.

Question 7

Correct

0.67 points out of 1.00

Flag question

Go ahead and calculate the number using the answer from the previous question. It is a big number, but most of us have a hard time understanding how much energy that is since it is in Joules. You can convert the number to equivalent tons of TNT by dividing the answer to the previous question by 4.184 times 10 to the 9th power. If you perform that calculation, how many tons of TNT is a magnitude 5 earthquake equivalent to?

Answer: 476.8 ✓

Check

Correct
Marks for this submission: 1.00/1.00. Accounting for previous tries, this gives **0.67/1.00**.

Question 8

Correct

1.00 points out of 1.00

Flag question

Ok, this has been an introduction to using the Python command line, but next we will create a program for running a series of commands like a script. Which command do you need to type to exit the Python command line and return to the Linux command line?

Answer: exit() ✓

Check

Correct
Marks for this submission: 1.00/1.00.

Question 9

Correct

1.00 points out of 1.00

Flag question

We will use python to help us understand typical earthquake aftershock patterns today. Take a minute to read some basic information about this topic on Wikipedia: https://en.wikipedia.org/wiki/Aftershock

What is the definition of an aftershock?

Answer: In seismology, an aftershock is a smaller earthquake that follows a larger earthquake, in the same area of the main shock, caused as the displaced crust adjusts to the effects of the main shock. ✓

Check

Correct
Marks for this submission: 1.00/1.00.

Question 10

Correct

1.00 points out of 1.00

Flag question

Which of the following describe how the rate of aftershocks decrease over time?

Select one:

- a. Omori's Law ✓
- b. Stochastic Law
- c. Båth's law
- d. Gutenberg–Richter law

Check

Correct
Marks for this submission: 1.00/1.00.

Question 11
Not answered
0.67 points out of 1.00
Flag question

The equation for Utsu's modified version of Omori's law is written as:

$n(t) = k / (c + t)^p$

Using the information from Wikipedia, match the variables with their descriptions:

constant defining the initial decay	Choose...
constant defining the overall rate	Choose...
rate of earthquakes at a given time	Choose...
time variable	Choose...
constant which modifies the overall decay rate	Choose...

Check

Correct
Marks for this submission: 1.00/1.00. Accounting for previous tries, this gives **0.67/1.00**.

Question 12
Correct
0.33 points out of 1.00
Flag question

The c constant is typically 10-60 sec. Looking at the equation, which of the following is true?

Select one:
- a. it will affect the decay rate during the time after the mainshock from seconds to days
- b. it will affect the decay rate during the time after the mainshock from seconds to minutes ✓
- c. it will affect the decay rate during the time after the mainshock for less than a few seconds only
- d. it will affect the decay rate during the time after the mainshock from seconds to months

Check

Correct
Marks for this submission: 1.00/1.00. Accounting for previous tries, this gives **0.33/1.00**.

Question 13
Correct
1.00 points out of 1.00
Flag question

The p constant typically falls in the range 0.7–1.5. However, if you consider the original Omori's law (not the one modified by Utsu), what is the most common p value?

Answer: 1 ✓

Check

Correct
Marks for this submission: 1.00/1.00.

Question 14
Correct
0.33 points out of 1.00
Flag question

Let's consider an aftershock sequence that can be fit with these values: k = 20 earthquakes, c = 30 seconds, and p = 1. Testing your math skills, what would be the rate of earthquakes per day at 2 days after the main shock?

Answer: 9.99826419136 ✓

Check

Correct
Marks for this submission: 1.00/1.00. Accounting for previous tries, this gives **0.33/1.00**.

Question 15
Correct
1.00 points out of 1.00
Flag question

Go ahead and open a new file called **omori.py** on the Linux command line to put your python commands in. On the command line, type in **gedit omori.py &** to get started. Once you open this file, add a comment on the first line that explains what this script is for like this:

```
# Omori Law calculator
```

To make this program adaptable for different Omori law values, we need to create variables for our values for k, c, and p. You can read about setting variables in Python at these websites or use your own web search:
https://www.openbookproject.net/thinkcs/python/english2e/ch02.html
https://www.learnpython.org/en/Variables_and_Types

Based on the information you reviewed, which of the following would follow the python syntax for setting the k value?

Select one:
- a. k:20
- b. set k= 20;
- c. set k= 20
- d. set k:20;
- e. k = 20;
- f. k = 20 ✓ Correct. Add this line to your omori.py file in gedit.

Check

Correct
Marks for this submission: 1.00/1.00.

Question 16
Correct
1.00 points out of 1.00
Flag question

Next you need to add a similar line to set the p variable. What command would accomplish this?

Select one:
- a. set p = 20
- b. p = 1.5
- c. p = 1 ✓ Correct. Add this line to your omori.py file in gedit.
- d. set p = 1
- e. p = 20
- f. set p = 1.5

Check

Correct
Marks for this submission: 1.00/1.00.

Question 17
Correct
1.00 points out of 1.00
Flag question

Based on the correct answer from the previous question and what you read on the pages about setting variables, what type of variable was p set to be?

Select one:
- a. integer ✓
- b. string
- c. complex
- d. whole number
- e. floating point

Check

Correct
Marks for this submission: 1.00/1.00.

Question 18
Correct
0.00 points out of 1.00
Flag question

Now we need to add a line to set the c value. We will set up the equation to produce the rate of earthquakes per day, so if the c value is 30 seconds, we need to convert that to a fraction of a day. Which of the following would accomplish this?

Select one:
- a. c = 30.0*3600/24
- b. c = 3600*24*30.0
- c. c = 30.0/3600*24
- d. c = 3600*24/30.0
- e. c = 30.0/3600/24 ✓ Correct. Add this line to your omori.py file in gedit.
- f. c = 3600/24/30.0

Check

Correct
Marks for this submission: 1.00/1.00. Accounting for previous tries, this gives **0.00/1.00**.

Question 19
Correct
1.00 points out of 1.00
Flag question

Based on the correct answer from the previous question and what you read on the pages about setting variables, what type of variable was c set to be?

Select one:
- a. integer
- b. complex
- c. whole number
- d. floating point ✓
- e. string

Check

Correct
Marks for this submission: 1.00/1.00.

Question 20
Correct
1.00 points out of 1.00
Flag question

Now you should add a line to print the value of the variable c while the program is running. Which of the following would accomplish this?

Select one:
- a. c
- b. echo $c
- c. print (c) ✓
- d. print ("c")
- e. print c
- f. print "c"

Check

Correct
Marks for this submission: 1.00/1.00.

Question 21
Correct

We will try to run everything we can through Python, so go ahead and add the appropriate command from the previous question to your script. Now on the Linux command line you can run your script with this command:

```
(iris) jupyter-[your username]:~/python/aftershocks> python omori.py
```

What number does it output for the value of c?

1.00 points out of 1.00

Flag question

Answer: 0.00034722222222222224

Check

Correct
Marks for this submission: 1.00/1.00.

Question 22

Correct

1.00 points out of 1.00

Flag question

Before we move on, you should comment out the line "print (c)" from your script as we do not want the output of print (c) in the next part of our script. Remember you can comment out a line by adding a **#** in front of the line.

Next we will add a loop to the program to calculate the rate of earthquakes at different time steps. Loops are a very useful part of computer programming for scientists to automate repetitive tasks and a common part of scientific programs. There are several choices for commands in python for constructing a loop. You can read more about these choices at these websites:

https://www.openbookproject.net/thinkcs/python/english2e/ch06.html
https://www.learnpython.org/en/Loops

Which of the following commands can be used to begin a loop in a Python program?

Select one or more:

- [x] a. for ✓ 1 of 2 correct answers
- [ ] b. loop
- [x] c. while ✓ 1 of 2 correct answers
- [ ] d. if
- [ ] e. break
- [ ] f. continue

Check

Correct
Marks for this submission: 1.00/1.00.

Question 23

Correct

1.00 points out of 1.00

Flag question

We will set up a loop to run from 0 to 40 days using a variable t. Which of the following pair of commands use the right format to accomplish this?

Select one:

- (•) a. t = 0
  while t <= 40: ✓ Correct. Add these two lines to your omori.py file in gedit.
- ( ) b. ts = [0 .. 40]
  for t in ts:
- ( ) c. t = [0 .. 40]
  for t:
- ( ) d. ts = [0 .. 40]
  while t in ts:
- ( ) e. t = [0 .. 40]
  while t:
- ( ) f. t = 0
  for t <= 40:

Check

Correct
Marks for this submission: 1.00/1.00.

Question 24

Correct

1.00 points out of 1.00

Flag question

Next we will need to add a line to calculate the rate of earthquakes per day using the Omori equation. Which of the following would accomplish this in Python?

Select one:

- ( ) a. n(t) = k / (c + t) ^ p
- (•) b. n = k / (c + t) ** p ✓ Correct. You will add this line to your omori.py file in gedit after the next question.
- ( ) c. n = k / c + t ** p
- ( ) d. n(t) = k / (c + t) ** p
- ( ) e. n(t) = k / c + t ^ p
- ( ) f. n = k / c + t ^ p
- ( ) g. n = k / (c + t) ^ p
- ( ) h. n(t) = k / c + t ** p

Check

Correct
Marks for this submission: 1.00/1.00.

Question 25

Correct

1.00 points out of 1.00

Flag question

You need to add the answer to the previous question to your omori.py file in gedit, but we have to be careful about how we add lines that are within a loop. Python is really picky about how you indent the commands in your program because it uses the indentation to know whether the commands are part of the loop or not. You can read more about these choices at these websites:
https://www.learnpython.org/en/Hello%2C_World%21
https://docs.python.org/3/tutorial/introduction.html#first-steps-towards-programming

How many spaces should you put in front of the answer to the previous question when adding it to your program?

Answer: 4

Check

Correct. Add the four spaces and then n = k / (c + t) ** p to your omori.py file in gedit.
Correct
Marks for this submission: 1.00/1.00.

Question 26

Correct

1.00 points out of 1.00

Flag question

Next you need to add a command inside the loop to output the earthquake rate at each time step. To help in making a plot of these values later in this assignment, I would recommend that you output the time and then the rate. Which of these commands would accomplish this in Python?

Select one:

- (•) a. print(t,n) ✓ Correct. Add this line to your omori.py file in gedit. Make sure there are 4 spaces in front of the command so that python knows it is part of the loop commands.
- ( ) b. print("t,n")
- ( ) c. print("n,t")
- ( ) d. print t,n
- ( ) e. print (n t)
- ( ) f. print "t,n"
- ( ) g. print "n,t"
- ( ) h. print n,t
- ( ) i. print (t n)
- ( ) j. print (n,t)

Check

Correct
Marks for this submission: 1.00/1.00.

Question 27

Correct

1.00 points out of 1.00

Flag question

The last command we need inside the loop is a line that will increment the time variable. I would like the time step to be half of a day for this assignment. Which of the following lines would accomplish this?

Select one:

- ( ) a. while t + .5
- ( ) b. for t + .5
- ( ) c. t + .5
- ( ) d. while t = t + .5
- (•) e. t = t + .5 ✓ Correct. Add this line to your omori.py file in gedit. Make sure there are 4 spaces in front of the command so that python knows it is part of the loop commands.
- ( ) f. for t = t + .5

Check

Correct
Marks for this submission: 1.00/1.00.

Question 28

Correct

1.00 points out of 1.00

Flag question

Once you have added the time increment, the program is ready to run. What would you type at the command line to run this in Python? Select all that apply.

Select one:

- (•) a. python omori.py ✓ Correct! Go ahead and run this command.
- ( ) b. omori.py
- ( ) c. omori.py python
- ( ) d. python

Check

Correct
Marks for this submission: 1.00/1.00.

Question 29

Correct

1.00 points out of 1.00

Flag question

When you run the program, what is the value of the time in days for the last line of output?

Answer: 40.0

Check

Correct
Marks for this submission: 1.00/1.00.

Question 30

Correct

1.00 points out of 1.00

Flag question

Using the output, what is the rate of earthquakes per day at 40 days after the mainshock?

Answer: 0.4999956597598979

Check

Correct
Marks for this submission: 1.00/1.00.

Question 31

Correct

1.00 points out of 1.00

Flag question

Using the output, what is the rate of earthquakes per day at 10 days after the mainshock?

Answer: 1.9999305579667372

Check

Correct

Marks for this submission: 1.00/1.00.

Question 32
Correct
1.00 points out of 1.00
Flag question

Using the output, what is the rate of earthquakes per day at 2 days after the mainshock?

Answer: 9.99826419024475

Check

Correct
Marks for this submission: 1.00/1.00.

Question 33
Correct
1.00 points out of 1.00
Flag question

Using the output, what is the rate of earthquakes per day at 1 day after the mainshock?

Answer: 19.993057965984033

Check

Correct
Marks for this submission: 1.00/1.00.

Question 34
Correct
1.00 points out of 1.00
Flag question

Using the output, what is the rate of earthquakes per day at 12 hours after the mainshock?

Answer: 39.97224149895905

Check

Correct
Marks for this submission: 1.00/1.00.

Question 35
Correct
1.00 points out of 1.00
Flag question

Next you will make a plot of this output. You should save the output of your program to a file. Which of the following will correctly accomplish this? Select all that apply.

Select one:
- a. python omori.py | omori.xy
- b. python omori.py >! omori.xy ✓ Correct! Go ahead and run this command now.
- c. python omori.xy >! omori.py
- d. python omori.xy | omori.py

Check

Correct
Marks for this submission: 1.00/1.00.

Question 36
Correct
0.67 points out of 1.00
Flag question

To make sure the command from the previous question worked correctly, how many lines are in the output file?

Answer: 81

Check

Correct
Marks for this submission: 1.00/1.00. Accounting for previous tries, this gives **0.67/1.00**.

Question 37
Correct
0.71 points out of 1.00
Flag question

Next I would like you plot the output file using GMT. Which of the following would be needed for the full GMT command?

Select one or more:
- a. omori.xy ✓ 1 of 6 correct answers
- b. -R0/10/0/10
- c. -Ba1f10
- d. plot
- e. gmt psxy ✓ 1 of 6 correct answers
- f. -JX5 ✓ 1 of 6 correct answers
- g. omori.py
- h. -R0/40/0/40 ✓ 1 of 6 correct answers
- i. -JM5
- j. >! omori.ps ✓ 1 of 6 correct answers
- k. -Ba10f1 ✓ 1 of 6 correct answers

Check

Now go ahead and run the full command: `gmt psxy omori.xy -R0/40/0/40 -JX5 -Ba10f1 >! omori.ps`

Correct
Marks for this submission: 1.00/1.00. Accounting for previous tries, this gives **0.71/1.00**.

Question 38
Correct
1.00 points out of
Flag question

Which command would you need to view the graphical output?

Answer: gv omori.ps &

Check

Correct
Marks for this submission: 1.00/1.00.

Question 39
Correct
0.00 points out of 1.00
Flag question

Once you view the plot, how would you describe the line that is plotted?

Select one:
- a. The rate of earthquakes decays very rapidly.
- b. The rate of earthquakes decays very gradually over the first few weeks and then is constant after a month.
- c. The rate of earthquakes decays very rapidly over the first few days and then is constant after a week.
- d. The rate of earthquakes decays very gradually.
- e. The rate of earthquakes decays very rapidly over the first few weeks and then is gradual after a month.
- f. The rate of earthquakes decays very gradually over the first few days and then is constant after a week.
- g. The rate of earthquakes decays very gradually over the first few days and then much more rapidly after a week.
- h. The rate of earthquakes decays very rapidly over the first few days and then much more gradually after a week. ✓
- i. The rate of earthquakes decays very rapidly over the first few weeks and then is constant after a month.
- j. The rate of earthquakes decays very gradually over the first few days and then much more rapidly after a month.

Check

Correct
Marks for this submission: 1.00/1.00. Accounting for previous tries, this gives **0.00/1.00**.

Finish review