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Started on	Thursday, August 11, 2022, 4:29 AM
State	Finished
Completed on	Thursday, August 11, 2022, 6:58 AM
Time taken	2 hours 29 mins
Marks	26.13/29.00
Grade	**90.11** out of 100.00

Question 1

Correct

1.00 points out of 1.00

Flag question

In this activity, you are going to continue learning and using Python to help with a few different tasks, including using arrays and plotting a sine wave. Login to the OSL and move into your folder named **python** and then create a folder inside of it named **numpy** and then move into this directory. What is the correct order of commands below to create, check, and then enter this **numpy** directory?

mkdir numpy	2 ✓
ls numpy	3 ✓
cd ~/python	1 ✓
cd numpy	4 ✓

Check

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

Correct

Marks for this submission: 1.00/1.00.

Question 2

Correct

1.00 points out of 1.00

Flag question

One of the key features you will work with today is how Python can load modules into your programs. Modules are extremely helpful because they extend the functionality of what Python can do. There are several modules that are commonly used by scientists, so I will try to introduce you to some of those today.

The first key module is called **NumPy**, which stands for Numerical Python. I have already made sure the NumPy package is installed on the OSL because it is so widely used. There are two websites I will point you to for getting started with this module. It is a very powerful module, so most sites get right into the details, but I think these two sites start more from an introductory point:

https://towardsdatascience.com/the-ultimate-beginners-guide-to-numpy-f5a2f99aef54
(here is a pdf version if you cannot read the online version)
https://stackabuse.com/numpy-tutorial-a-simple-example-based-guide/

Based on what you can gather from these sites, which command do most people use to load numpy into their python program?

Select one:

- a. module load numpy
- b. install numpy
- c. import numpy as np ✓ Correct. Go ahead and run this command after you start python.
- d. module load numpy as np
- e. import numpy
- f. install numpy as np

Check

Correct

Marks for this submission: 1.00/1.00.

Question 3

Correct

1.00 points out of 1.00

Flag question

We will start this assignment using the Python command line interface. Go ahead and start python and load numpy using the answer to the previous question.

NOTE: Nothing visible should happen after running the command to load the numpy library. However, some students have reported getting an extensive ImportError instead. If you get a visible error and the numpy library does not load, you can exit Python and try this command:

```
sudo pip install --upgrade --force-reinstall numpy
```

It will take a minute to install and it might spit out some warnings, but after the reinstall, you should be able to go back into `python` and try loading numpy again. If you still encounter errors, let us know in Slack.

Most people consider one of the most useful things about numpy to be its array feature. Arrays are a very common tool in computer programming because you can store a series of values together in an array. In modern seismology, seismograms are usually stored as some form of array in any computer program you are using. If you've never heard of an array before and would like to read some more of an introduction about them, this is a good site:

https://www.toolsqa.com/data-structures/array-in-programming/

Based on what you read at this site (or others on the internet), how do you access the elements of an array?

Select one:

- a. the chapter number
- b. the index number ✓ Correct. You can refer to individual values in the array based on their index using this format: `array[index]`
- c. the score number
- d. the order number
- e. the lookup number

Check

Correct

Marks for this submission: 1.00/1.00.

Question 4

Correct

1.00 points out of 1.00

Flag question

Now let's create an array called **mags** that has nine values from 1 to 9 to represent the whole number magnitudes of earthquakes we can typically observe. Which of the following commands would accomplish this with numpy?

Select one:

- a. mags = np.array[1,2,3,4,5,6,7,8,9]
- b. mags = np.array([1,2,3,4,5,6,7,8,9]) ✓ Correct. Go ahead and run this command.
- c. mags = array[1,2,3,4,5,6,7,8,9]
- d. mags = array["1,2,3,4,5,6,7,8,9"]
- e. mags = array(1,2,3,4,5,6,7,8,9)
- f. mags = np.array["1,2,3,4,5,6,7,8,9"]
- g. mags = np.array(1,2,3,4,5,6,7,8,9)
- h. mags = np.array("[1,2,3,4,5,6,7,8,9]")
- i. mags = array([1,2,3,4,5,6,7,8,9])
- j. mags = array("[1,2,3,4,5,6,7,8,9]")

Check

Correct

Marks for this submission: 1.00/1.00.

Question 5

Correct

1.00 points out of 1.00

Flag question

Ok, so how would you print the value of the array at index number 4?

Select one:

- a. print mags[4]
- b. print ("mags,4")
- c. print (mags,4)
- d. print (mags(4))
- e. print (mags[4]) ✓ Correct. Go ahead and run this command.
- f. print mags(4)
- g. print "mags(4)"
- h. print mags,4
- i. print ("mags[4]")

Check

Correct

Marks for this submission: 1.00/1.00.

Question 6

Correct

1.00 points out of

Flag question

What is the value of the array at index number 4?

Answer: 5 ✓

Check

Correct.

Correct

Marks for this submission: 1.00/1.00.

Question 7

Correct

1.00 points out of 1.00

Flag question

I'm guessing the answer to the previous question may have been a little surprising if you haven't used an array before. Based on the answer to the previous question (and playing with the value of the index), which index number does Python store the first magnitude value (1) in?

Answer: 0 ✓

Check

Correct.

Correct

Marks for this submission: 1.00/1.00.

Question 8

Correct

1.00 points out of 1.00

Flag question

Now let's demonstrate how arrays are effective for numerical analysis. You can use the values in the array as the input for a set of calculations. For example, in our last assignment we calculated the equivalent energy release from a magnitude 5 earthquake in terms of explosives. The equation we used is:

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

And we divided the energy by $4.184 * 10^9$ to convert from Joules to tons of TNT explosives.

Which of the following commands would create a new array called **energies** by performing this calculation on the **mags** array?

Select one:

- a. energies = 10 ** (1.5 * M + 4.8) / (4.184 * 10 ** 9)
- b. energies = 10 ** (1.5 * M + 4.8) * (4.184 * 10 ** 9)
- c. energies = 10 ** (1.5 * mags + 4.8) * (4.184 * 10 ** 9)
- d. energies = 10 ^ (1.5 * mags + 4.8) * (4.184 * 10 ^ 9)
- e. energies = 10 ^ (1.5 * mags + 4.8) / (4.184 * 10 ^ 9)
- f. energies = 10 ^ (1.5 * M + 4.8) / (4.184 * 10 ^ 9)
- g. energies = 10 ** (1.5 * mags + 4.8) / (4.184 * 10 ** 9) ✓
- h. energies = 10 ^ (1.5 * M + 4.8) * (4.184 * 10 ^ 9)

Check

Correct

Marks for this submission: 1.00/1.00.

Question 9

Correct

1.00 points out of 1.00

Flag question

Go ahead and print the resulting values in the **energies** array:

```
print (energies)
```

Which whole number earthquake magnitude is the first to create more energy release than 1 ton of TNT explosives?

Answer: 4 ✓

Check

Correct.

Correct

Marks for this submission: 1.00/1.00.

Question 10

Correct

1.00 points out of 1.00

Flag question

For the next part of the tutorial you will use a python program file, so you can exit out of the python command line interface using quit(). Open this new file called **sine.py** with gedit or your favorite text editor. Add a comment on the first line like:

```
# Sine wave plot tool
```

Then add a line to load the numpy module like we did earlier. What is the full command we should add to accomplish this?

Answer: import numpy as np ✓

Check

Correct. Add `import numpy as np` to your program.

Correct

Marks for this submission: 1.00/1.00.

Question 11

Correct

1.00 points out of 1.00

Flag question

For this program, we will also create a plot, so we will load the very commonly used **matplotlib** module. This module has many features to help with making a wide variety of plots and analyses with Python. I would recommend these website for getting started learning about plotting in matplotlib:
https://matplotlib.org/tutorials/introductory/pyplot.html
https://www.geeksforgeeks.org/graph-plotting-in-python-set-1/

I also found this short video to be very helpful:
https://youtube.com/watch?v=D4VlmL3G4_o

What is the collection of functions within the matplotlib module used for plotting?

Select one:

- a. import
- b. matplotlib
- c. pyplot ✓
- d. plot
- e. plt

Check

Correct

Marks for this submission: 1.00/1.00.

Question 12

Correct

1.00 points out of 1.00

Flag question

What is the most common full command to load the collection of functions into your program? Hint 1: It will use the same command as when you loaded numpy. Hint 2: Nearly all matplotlib tutorials use this same command to load it into a particular alias.

Select one or more:

- a. plt.plot
- b. plt ✓ 1 of 4 correct answers
- c. as ✓ 1 of 4 correct answers
- d. matplotlib.pyplot ✓ 1 of 4 correct answers
- e. import ✓ 1 of 4 correct answers
- f. matplotlib
- g. install
- h. pyplot

Check

Go ahead and load pyplot as an alias named plt: `import matplotlib.pyplot as plt`

Correct

Marks for this submission: 1.00/1.00.

Question 13

Correct

1.00 points out of 1.00

Flag question

Now that the plotting functions are loaded, we can start preparing the values we want to plot. You are going to create a plot of a sine wave with the initial frequency of 2 and an amplitude of 1:

```
f = 2 # frequency of sine wave
A = 1 # maximum amplitude of sine wave
```

Note how I have added a comment at the end of the command to set the variable to help remind me what the one-letter variables represent. The purpose of using a variable is so that you can easily change them later (and we will). To help you recall your knowledge of waves, which of the following commands would create a shorter period wave?

Select one:

- a. f = 1
- b. A = 0.4
- c. A = 2
- d. f = 4 ✓ Correct. Keep the program as f = 2 though (do not change the value to 4 for now).

Check

Correct

Marks for this submission: 1.00/1.00.

Question 14

Correct

1.00 points out of 1.00

Flag question

Next we need to define an array for the angle for our sine function. We will call it x because it will be the variable plotted on the x-axis. We will set it to go from negative pi to positive pi to cover a good range of angles in radians. We will use a small increment of 0.01 to make sure the line in our plot is smooth. You should use the arange function of the numpy package. Taking a moment to review the numpy resources I provided earlier, which of the following commands would accomplish creating this array?

Select one:

- a. x = np.arange(-3.14, 3.14, 0.01) ✓ Correct. Be sure to add this line to your program now.
- b. x = arange(-3.14, 3.14, 0.01)
- c. arange("x", "-3.14", "3.14", "0.01")
- d. np.arange(x, -3.14, 3.14, 0.01)
- e. np.arange("x", "-3.14", "3.14", "0.01")
- f. arange(x, -3.14, 3.14, 0.01)
- g. x = arange("-3.14", "3.14", "0.01")
- h. x = np.arange("-3.14", "3.14", "0.01")

Check

Correct

Marks for this submission: 1.00/1.00.

Question 15

Correct

1.00 points out of 1.00

Flag question

Next we need to construct an array for the sine wave amplitudes at each of the angle values we defined in the last question. We will call this array y because it will be the variable plotted on the y-axis. You will determine the amplitude values by using the sin function from numpy. Taking a moment to review the numpy resources I provided earlier, which of the following would accomplish creating this array?

Select one:

- a. y = [numpy.sine(x)]
- b. y = [np.sin(x)]
- c. y = np.sin[x]
- d. y = [sine(x)]
- e. y = numpy.sin[x]
- f. y = numpy.sine(x)
- g. y = np.sin(x) ✓ Correct, but do NOT add this line to your program yet.
- h. y = sine[x]
- i. y = sin[x]
- j. y = np.sine(x)
- k. y = sin(x)
- l. y = [numpy.sin(x)]

Check

Correct

Marks for this submission: 1.00/1.00.

Question 16

Correct

0.33 points out of 1.00

Flag question

Note that we defined the amplitude and frequency variables earlier in our program, so we should make sure to use them in the calculation of the y array. Which of the following would create the y array using these variables to adjust the sine wave?

Select one:

- a. y = np.sin(f * x) / A
- b. y = f * np.sin(A * x)
- c. y = A * sin(f * x)
- d. y = f * sin(A * x)
- e. y = sin(A * x) / f
- f. y = sin(f * x) / A
- g. y = np.sin(A * x) / f
- h. y = A * np.sin(f * x) ✓ Correct. Now you can add this line to your program.

Check

Correct

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

Question 17

Correct

1.00 points out of 1.00

Flag question

Now it is time to plot the sine wave. Taking a moment to review the matplotlib resources I provided earlier, which of the following would add the x and y coordinates to the plot?

Select one:

- a. plot(x,y)
- b. plot(1, 2, 3, 4)
- c. plt.plot(x,y) ✓ Correct. Add this line to your program.
- d. plt.plot(1, 2, 3, 4)
- e. plt[1, 2, 3, 4]
- f. plot([x,y])
- g. plt(x,y)

- h. plt.plot([x,y])
- i. plot([1, 2, 3, 4])
- j. plt.plot([1, 2, 3, 4])

Check

Correct
Marks for this submission: 1.00/1.00.

Question 18
Correct
1.00 points out of 1.00
Flag question

There are many tweaks you can make to your plot area with matplotlib, and the matplotlib resources I provided earlier only provide some guidance on the basic options. For this assignment, you only need to add labels to the x and y axes. Which of the following would be necessary to accomplish this correctly?

Select one or more:
- a. plt.xlabel('angle') ✓ 1 of 2 correct answers. Add this line to your program.
- b. plt.ylabel('amplitude') ✓ 1 of 2 correct answers. Add this line to your program.
- c. ylabel('angle')
- d. xlabel('angle')
- e. plt.xlabel('amplitude')
- f. plt.ylabel('angle')
- g. xlabel('amplitude')
- h. ylabel('amplitude')

Check

Correct
Marks for this submission: 1.00/1.00.

Question 19
Correct
1.00 points out of 1.00
Flag question

Taking a moment to review the matplotlib resources I provided earlier, which of the following would be the correct command to bring up a graphics window that shows the plot?

Answer: plt.show() ✓

Check

Correct. Add this line to your program.
Correct
Marks for this submission: 1.00/1.00.

Question 20
Correct
1.00 points out of 1.00
Flag question

Make sure your program file is saved and then it is time to run the program. How would you run your program?

Answer: python sine.py ✓

Check

Correct. Go ahead and run `python sine.py &` to help preserve your command line interface.
Correct
Marks for this submission: 1.00/1.00.

Question 21
Correct
1.00 points out of 1.00
Flag question

What does your plot look like?

Select one:
- a. one cycle of a sine wave with a maximum amplitude of 1
- b. one cycle of a sine wave with a maximum amplitude of 2
- c. four cycle of a sine wave with a maximum amplitude of 2
- d. four cycles of a sine wave with a maximum amplitude of 1
- e. two cycles of a sine wave with a maximum amplitude of 2
- f. two cycles of a sine wave with a maximum amplitude of 1 ✓

Check

Correct
Marks for this submission: 1.00/1.00.

Question 22
Correct
1.00 points out of 1.00
Flag question

Next try setting a different amplitude of 5 for the sine wave. Which line in your program should be changed to accomplish this?

Select one:
- a. y = A * np.sin(f * x)
- b. plt.plot(x,y)
- c. plt.xlabel('angle')
- d. plt.ylabel('amplitude')
- e. x = np.arange(-3.14, 3.14, 0.01)
- f. f = 2
- g. A = 1 ✓ Correct. Change this line to be: `A = 5`

Check

Correct
Marks for this submission: 1.00/1.00.

Question 23
Correct
0.50 points out of 1.00
Flag question

What happens when you run the program again with the adjustment?

Select one or more:
- a. The y-axis values do not change.
- b. The vertical size of the plot does not change. ✓ 1 of 4 correct answers.
- c. The y-axis values are larger. ✓ 1 of 4 correct answers.
- d. The horizontal size of the plot is smaller.
- e. The x-axis values do not change. ✓ 1 of 4 correct answers.
- f. The x-axis values are smaller.
- g. The horizontal size of the plot is larger.
- h. The y-axis values are smaller.
- i. The horizontal size of the plot does not change. ✓ 1 of 4 correct answers.
- j. The x-axis values are larger.
- k. The vertical size of the plot is larger.
- l. The vertical size of the plot is smaller.

Check

Correct
Marks for this submission: 1.00/1.00. Accounting for previous tries, this gives **0.50/1.00**.

Question 24
Correct
1.00 points out of 1.00
Flag question

Next try setting different frequency of 0.5 for the since wave. Which line in your program should be changed to accomplish this?

Select one:
- a. f = 2 ✓ Correct. Change this line to be: `f = 0.5`
- b. plt.plot(x,y)
- c. plt.ylabel('amplitude')
- d. plt.xlabel('angle')
- e. x = np.arange(-3.14, 3.14, 0.01)
- f. y = A * np.sin(f * x)
- g. A = 5

Check

Correct
Marks for this submission: 1.00/1.00.

Question 25
Correct
0.30 points out of 1.00
Flag question

Compared to the most recent plot you made, what happens when you run the program again with this adjustment?

Select one or more:
- a. The x-axis values are larger.
- b. The y-axis values do not change. ✓ 1 of 4 correct answers.
- c. The y-axis values are larger.
- d. More sine wave cycles are shown.
- e. The x-axis values are smaller.
- f. The x-axis values do not change. ✓ 1 of 4 correct answers.
- g. The y-axis values are smaller.
- h. The same number of sine wave cycles are shown.
- i. A larger portion of the sine wave amplitude range is shown.
- j. The same portion of the sine wave amplitude range is shown. ✓ 1 of 4 correct answers.
- k. A smaller portion of the sine wave amplitude range is shown.
- l. A smaller portion of the sine wave cycle is shown. ✓ 1 of 4 correct answers.

Check

Correct
Marks for this submission: 1.00/1.00. Accounting for previous tries, this gives **0.30/1.00**.

Question 26
Correct
1.00 points out of 1.00
Flag question

Next try setting different range of x values from negative two pi to positive two pi. Which line in your program should be changed to accomplish this?

Select one:
- a. x = np.arange(-3.14, 3.14, 0.01) ✓ Correct. Change this line to be: `x = np.arange(-6.28, 6.28, 0.01)`
- b. plt.ylabel('amplitude')
- c. f = 0.5
- d. A = 5
- e. plt.plot(x,y)
- f. plt.xlabel('angle')

g. y = A * np.sin(f * x)

Check

Correct
Marks for this submission: 1.00/1.00.

Question 27
Correct
0.33 points out of 1.00
Flag question

Compared to the most recent plot you made, what happens when you run the program again with this adjustment?

Select one or more:

- [x] a. The same portion of the sine wave amplitude range is shown. ✓ 1 of 4 correct answers.
- [ ] b. The x-axis values are smaller.
- [ ] c. The y-axis values are larger.
- [ ] d. The y-axis values are smaller.
- [ ] e. A larger portion of the sine wave amplitude range is shown.
- [ ] f. A smaller portion of the sine wave cycle is shown.
- [x] g. The x-axis values are larger. ✓ 1 of 4 correct answers.
- [ ] h. A smaller portion of the sine wave amplitude range is shown.
- [x] i. The y-axis values do not change. ✓ 1 of 4 correct answers.
- [ ] j. The x-axis values do not change.
- [ ] k. The same number of sine wave cycles are shown.
- [x] l. A full sine wave cycle is shown. ✓ 1 of 4 correct answers.

Check

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

Question 28
Correct
1.00 points out of 1.00
Flag question

Next try plotting the tangent function instead of the sine function. Which line in your program should be changed to accomplish this?

Select one:

- a. x = np.arange(-6.28, 6.28, 0.01)
- b. plt.xlabel('angle')
- c. plt.ylabel('amplitude')
- d. plt.plot(x,y)
- e. A = 5
- f. f = 0.5
- g. y = A * np.sin(f * x) ✓ Correct. Change this line to be: `y = A * np.tan( f * x )`

Check

Correct
Marks for this submission: 1.00/1.00.

Question 29
Correct
0.67 points out of 1.00
Flag question

Compared to the most recent plot you made, what happens when you run the program again with this adjustment?

Select one or more:

- [ ] a. The x-axis values are smaller.
- [ ] b. The amplitude stops at 5.
- [ ] c. The curvature of the tangent wave looks the same as the sine wave.
- [ ] d. The x-axis values are larger.
- [ ] e. The y-axis values are smaller.
- [x] f. The x-axis values do not change. ✓ 1 of 4 correct answers.
- [ ] g. The y-axis values do not change.
- [x] h. The curvature of the tangent wave is harder to see than the sine wave. ✓ 1 of 4 correct answers.
- [ ] i. The curvature of the tangent wave is easier to see than the sine wave.
- [x] j. The y-axis values are larger. ✓ 1 of 4 correct answers.
- [x] k. The amplitude tries to go to infinity by stops at values around 6000. ✓ 1 of 4 correct answers.
- [ ] l. The amplitude goes all the way to infinity

Check

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

Finish review