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

Show one page at a time

Finish review

Started on	Wednesday, August 3, 2022, 7:54 AM
State	Finished
Completed on	Wednesday, August 3, 2022, 7:58 AM
Time taken	4 mins 16 secs
Marks	24.00/24.00
Grade	**100.00** out of 100.00

Question 1

Correct

1.00 points out of 1.00

Flag question

1. Time-Domain vs. Frequency Domain

Since seismograms can be a complex time series, we use many different kinds of techniques to analyze the signals. One common technique is frequency analysis, sometimes called Fourier Analysis. This involves looking at the signals in terms of their frequency content, often referred to as the spectrum. To help give you an introduction to frequency analysis (often called spectral analysis), I found this webpage on betterexplained.com about time and frequency representation. It will take several minutes to read through this page, but my hope is that it will significantly help your understanding of why Frequency Analysis is important and how it works. The first few questions of this assignment are based on this webpage, to confirm your understanding.

In the analogy given to help explain the Fourier Transform, which part is used to represent the frequency content of a signal?

Select one:

- a. the banana filter
- b. the recipe ✓
- c. the amount of banana
- d. the smoothie

Check

Correct
Marks for this submission: 1.00/1.00.

Question 2

Correct

1.00 points out of 1.00

Flag question

For seismic waves, what does the Fourier Transform do?

Select one:

- a. removes random noise
- b. separates the signal into "ingredients" (vibrations of different speeds & strengths) ✓
- c. ignores the least-important oscillation patterns
- d. causes buildings to avoid interacting with the strongest vibrations

Check

Correct
Marks for this submission: 1.00/1.00.

Question 3

Correct

1.00 points out of 1.00

Flag question

Using the explanation of Circular Paths, I would like us to try another circle drawing example. For my example, let's draw a 4-inch radius circle with our starting point at 90 degrees, and we draw 1 circle every 10 seconds! Remember that we measure the angle from the positive x-axis in the counter-clockwise direction, so our starting point for the circle is at the positive y-axis. (Note that this is different than the azimuth we typically use in geology that is measured in the clockwise direction from the positive y-axis). After 5 seconds, where would you be?

Select one:

- a. the negative y-axis ✓
- b. the negative x-axis
- c. lost
- d. the positive y-axis
- e. the positive x-axis

Check

Correct
Marks for this submission: 1.00/1.00.

Question 4

Correct

1.00 points out of 1.00

Flag question

In the animation that illustrates how the circular representations are related to time series we would measure, we can adjust the types of signals that are being shown. First, set the Cycles part to 1 0 0. What does this represent? Choose all that apply.

Select one or more:

- a. 1 strength for the 2Hz cycle
- b. 1 strength for the 0Hz cycle ✓ 1 of 3 correct answers.
- c. 0 strength for the 0Hz cycle
- d. 0 strength for the 2Hz cycle ✓ 1 of 3 correct answers.
- e. 0 strength for the 1Hz cycle ✓ 1 of 3 correct answers.
- f. 1 strength for the 1Hz cycle

Check

Correct
Marks for this submission: 1.00/1.00.

Question 5

Correct

1.00 points out of 1.00

Flag question

What does the signal look like when you set the Cycles part to 1 0 0? Make sure that the Total box is checked and the Parts box is unchecked.

Select one:

- a. A 2 Hz sine wave that goes up to an amplitude of 2
- b. A flat line at an amplitude of 1 ✓
- c. A flat line at an amplitude of 0
- d. A 2 Hz sine wave that goes up to an amplitude of 1
- e. A 1 Hz sine wave that goes up to an amplitude of 2
- f. A 1 Hz sine wave that goes up to an amplitude of 1

Check

Correct
Marks for this submission: 1.00/1.00.

Question 6

Correct

1.00 points out of 1.00

Flag question

2. Frequency Analysis in SAC

Now we can start to use SAC to do some frequency analysis. Make sure you are logged into OpenSARlab and then move to the **sac** directory and start `sac`. In SAC, you can generate a time series with a sine function of 2 Hz over 2 seconds of time with the FUNCGEN command we used earlier. Which of the following commands would produce that signal? Feel free to try the commands below in SAC and then plot the results to make sure it is producing a time series with a sine function of 2 Hz over 2 seconds.

Select one:

- a. FG SINE 2
- b. FG SINE 2 NPTS 100 DELTA .2
- c. FG SINE 2 NPTS 2 DELTA .1
- d. FG SINE 2 NPTS 200 DELTA .01 ✓ Correct. Please make sure you run this command in SAC if you have not already done so. If you get an error, make sure you have spaces between the parameters and the values.
- e. FG SINE 2 TIME 2

Check

Correct
Marks for this submission: 1.00/1.00.

Question 7

Correct

1.00 points out of 1.00

Flag question

What should a spectral plot of the frequency content in this signal look like?

Select one:

- a. A peak at 2 Hz ✓
- b. A function that is close to zero before 2 Hz and maximum amplitude after 2 Hz
- c. A sine wave
- d. A flat line

Check

This is a more difficult question if you haven't thought about spectral plots before, but if you are really confused, you might find this optional video resource we provided on the main Moodle page to be helpful.

Correct
Marks for this submission: 1.00/1.00.

Question 8

Correct

1.00 points out of 1.00

Flag question

Then you can perform the fast-fourier transform using the FFT command.

```
SAC> FFT
```

Now the sine wave time series will be converted to the frequency domain. What happens when you try to PLOT the results?

Select one:

- a. ERROR 1307: Illegal operation on spectral file ✓ Correct, the regular PLOT command will not work because we have converted the time series to a spectral series that has information about the different frequency components of the original time series.
- b. SAC plots a sine wave
- c. ERROR 1301: No data files read in.
- d. DC level after DFT is 1.0207e-09
- e. ERROR 1305: Illegal operation on time series file
- f. Nothing

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 the PLOTSP command to plot the frequency spectrum (abbreviation PSP). For right now, we can use the AM and LOGLIN options to just plot the amplitude part of the frequency component and do a logarithmic X-axis and linear Y-axis.

```
SAC> PLOTSP AM LOGLIN
```

Please note that the X-axis in this plot can be confusing. First, you should see that it is logarithmic, so the values will be unevenly spaced to reflect this. Second, it will use the exponential/scientific number representation for numbers on the X-axis. Note that it labels 10 to the 0 power (which is 1) and 10 to the 1 power (which is 10). The values to the right of each are of the same order, so that the 2 to the right of 10 to the 1 power represents 20. I know this is confusing, but this is how SAC tries to represent numbers in a compact way.

To make sure we are understand how SAC plots the X-axis in a spectral plot, what is the approximate minimum value on the X-axis?

Answer: 0.4 ✓

Check

Correct
Marks for this submission: 1.00/1.00.

Question 10

Correct

1.00 points out of 1.00

Flag question

To make sure we are understand how SAC plots the X-axis plot, what is the approximate maximum value on the X-axis?

Answer: 40 ✓

Check

Correct
Marks for this submission: 1.00/1.00.

Question 11

Correct

1.00 points out of 1.00

Flag question

What does the actual plot look like?

Select one:

- a. A sine wave
- b. A flat line
- c. A function that is close to zero before 2 Hz and maximum amplitude after 2 Hz
- d. A peak at 2 Hz ✓

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 maximum amplitude of the frequency content in the plot?

Answer: 1 ✓

Check

Correct
Marks for this submission: 1.00/1.00.

Question 13

Correct

1.00 points out of 1.00

Flag question

We can do the same type of frequency analysis with a impulse function too. Before you do it though, think about what the frequency domain plot will look like for an impulse function. What should the result look like?

Select one:

- a. A flat line ✓
- b. A sine wave
- c. A function that is close to zero before 2 Hz and maximum amplitude after 2 Hz
- d. A peak at 2 Hz

Check

Correct
Marks for this submission: 1.00/1.00.

Question 14

Correct

1.00 points out of 1.00

Flag question

Now we can calculate the Fourier Transform of the impulse function to make sure our intuition is correct:

```
SAC> FG IMPULSE NPTS 100 DELTA .1
SAC> FFT
```

Which of the following commands would show us the results?

Select one:

- a. PLOT AM LOGLIN
- b. PLOT
- c. PPK AM LOGLIN
- d. PSP AM LOGLIN ✓
- e. PPK

Check

Correct
Marks for this submission: 1.00/1.00.

Question 15

Correct

1.00 points out of 1.00

What does the plot look like?

Select one:

Flag question

a. A flat line ✓
b. A peak at 2 Hz
c. A sine wave
d. A function that is close to zero before 2 Hz and maximum amplitude after 2 Hz

Check

Correct
Marks for this submission: 1.00/1.00.

Question 16
Correct
1.00 points out of 1.00
Flag question

What is the maximum amplitude of the frequency content in the plot?

Answer: 0.1 ✓

Check

Correct
Marks for this submission: 1.00/1.00.

Question 17
Correct
1.00 points out of 1.00
Flag question

Which of the following functions would produce an approximate amplitude of 1 in the frequency content plot?

Select one:
a. FG IMPULSE NPTS 1 DELTA .1
b. FG IMPULSE NPTS 100 DELTA 1 ✓
c. FG IMPULSE NPTS 100 DELTA .1
d. FG IMPULSE NPTS 100 DELTA .01
e. FG IMPULSE NPTS 10 DELTA .1

Check

Correct
Marks for this submission: 1.00/1.00.

Question 18
Correct
1.00 points out of 1.00
Flag question

3. Filtering

Now we can try filtering the data based on the frequency content to change how the signal looks in the time domain. One of the ways to do that in SAC is with the BANDPASS command (abbreviated BP). This command applies a bandpass filter to the data currently in memory. Bandpass refers to the fact that we will allow a band of frequencies to "pass" through the filter, while other frequencies will be rejected. The edges of the frequency band are identified with the CORNER option.

```
SAC> FG IMPULSE NPTS 100 DELTA .1
SAC> P
SAC> BANDPASS CORNER .1 .3
SAC> P
```

What does the result look like?

Select one:
a. A sine wave with 0.2 Hz frequency
b. Flat until time 5 and then a decaying sine wave after that ✓
c. A peak at time 5
d. A flat line

Check

Correct
Marks for this submission: 1.00/1.00.

Question 19
Correct
1.00 points out of 1.00
Flag question

How does the amplitude change when applying this filter? You may want to run the commands again to compare the amplitudes before and after filtering.

Select one:
a. More than an order of magnitude larger
b. No change
c. More than an order of magnitude smaller ✓
d. Less than an order of magnitude larger
e. Less than an order of magnitude smaller

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 look at the filtered signal in the frequency domain. Since you already have the filtered signal in memory, which two commands do you need to view the spectrum of the filtered signal?

Select one or more:
a. FG
b. PSP ✓ 1 of 2 correct answers. Please run this second.
c. BANDPASS
d. FFT ✓ 1 of 2 correct answers. Please run this first.
e. PLOT

Check

Correct
Marks for this submission: 1.00/1.00.

Question 21
Correct
1.00 points out of 1.00
Flag question

To make sure we are understand how SAC plots the X-axis in a spectral plot, what is the approximate minimum value on the X-axis?

Answer: 0.08 ✓

Check

Correct
Marks for this submission: 1.00/1.00.

Question 22
Correct
1.00 points out of 1.00
Flag question

To make sure we are understand how SAC plots the X-axis plot, what is the approximate maximum value on the X-axis?

Answer: 4 ✓

Check

Correct
Marks for this submission: 1.00/1.00.

Question 23
Correct
1.00 points out of 1.00
Flag question

What does the spectral plot of the frequency content of the filtered signal look like?

Select one:
a. A bump with a peak around 0.2 Hz ✓
b. Flat until 5 and then a decaying sine wave after that
c. A bump with a peak around 2 Hz
d. Flat line

Check

Correct
Marks for this submission: 1.00/1.00.

Question 24
Correct
1.00 points out of 1.00
Flag question

How might we use filtering in seismology to change our time domain signals?

Select one:
a. We can eliminate earthquakes where the signal to noise ratio is too small such that it is difficult to pick phase arrivals.
b. We can eliminate certain types of earthquakes that might be too far away and focus on the earthquakes that are closer to the sensor.
c. We can add certain frequency ranges that might contain noise and focus on the frequency ranges where there are signals we are most interested in.
d. We can eliminate certain frequency ranges that might contain noise and focus on the frequency ranges where there are signals we are most interested in. ✓

Check

Your answer is correct.
Correct
Marks for this submission: 1.00/1.00.

Finish review