

1. Personal information
   1. Gender
   2. Years of college
   3. Years of college math
   4. Major
   5. First generation college student
   6. Year of birth
   7. City of birth
2. Earthquake seismograms record the time of arrival for the different waves generated. Figure 1a 1b and 1c all display the same raw seismic data from a distant earthquake, with figure 1a displaying the time domain and figure 1b and 1c displaying the data in the frequency domain. Please use these figures for the following or indicate that you do not know:
   1. Describe the frequency content of the primary wave.

We rated student responses 1-5

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| **Id** | **Treatment** | **Pre- response** | **Pre- Rank** | **Post- response** | **Post- Rank** |
| UW-1 | 1 | high frequency | 4 |  | NA |
| UW-2 | 1 | ~ 20 Hz | 5 |  | NA |
| UW-3 | 1 | About 25 Hz at the primary maximum | 5 | The primary wave approached 20 Hz. | 5 |
| UW-4 | 1 | high frequency | 4 | High frequency | 4 |
| UW-5 | 1 | Content? ~25Hz | 4 |  | NA |
| UW-6 | 1 | It has a lot of displacement | 5 | The primary wave has a very high frequency at about 10Hz. | 4 |
| UW-7 | 1 | Impulsive, ranging from 0 to 22 Hz | 2 | The primary wave has a frequency range of about 0-20 Hz with the highest amplitude in the frequency range of 0-10 Hz | 1 |
| UW-8 | 1 | Primary wave has a diversified distribution of frequencies from range [0 - 25]Hz, with the lower frequencies having higher amplitudes. | 1 |  | NA |
| UW-9 | 1 |  | 5 | high frequency | 4 |
| UW-10 | 1 | about 25 Hz | 5 | about 22 Hz | 5 |
| UW-11 | 1 | High frequency | 4 |  | NA |
| UW-12 | 1 | high frequency | 4 | high frequency | 4 |
| UW-13 | 1 | 30 Hz | 5 | HIgh frequency, low amplitude | 4 |
| UW-14 | 2 | The primary waye has a frequency of about 25 Hz | 5 | Very low frequency | 5 |
| UW-15 | 2 | It's about 20 Hz | 5 | The frequency is very high, about 20 Hz | 5 |
| UW-16 | 2 | 25 Hz? | 5 | about 25 Hz | 5 |
| UW-17 | 2 | 25hz | 5 | high frequency (~25Hz) | 5 |
| UW-18 | 2 | Wave contains frequencies of 0 to ~25 Hz, but mostly in the 0 - 20 Hz range | 2 | full range is 0 - 20 Hz, majority of energy in 0 - 5 Hz range | 1 |
| UW-19 | 2 | High frequency | 4 | Between 5 and 20 Hz | 2 |
| UW-20 | 2 | Around 20 to 25 Hz | 5 |  |  |
| UW-21 | 2 | 23 Hz | 5 | This is the highest frequency wave. | 3 |
| UW-22 | 2 | 20Hz | 5 | The primary wave has a frequency maximum of 20Hz with most of the activity around 5Hz. | 1 |
| UW-23 | 2 | Highest frequency & highest displacement | 5 |  | NA |
| UW-24 | 2 | the primary wave ranges from 0 to ~24 Hz | 2 | under 5 Hz | 3 |

* 1. Approximate the time and frequency of the largest amplitude arrival.

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| **ID** | **Treatment** | **Pre- response** | **Pre- Rank** | **Post- response** | **Post- Rank** |
| UW-1 | 1 | ~23 seconds, frequency ~7Hz | 4 |  | NA |
| UW-2 | 1 | ~800 seconds at ~ 10 Hz | 3 |  | NA |
| UW-3 | 1 | 400 s and 25Hz | 4 | 800 sec and 1 Hz | 1 |
| UW-4 | 1 | t=20 f=400 | 4 | t = 400s f= 22 | 4 |
| UW-5 | 1 | ~900 seconds, ~20Hz | 3 |  | NA |
| UW-6 | 1 | 10 s, 20 hz | 4 | The largest amplitude arrival occurred at about 750 secs. | 3 |
| UW-7 | 1 | time = 350 s. Frequency = 22 Hz | 4 | The time is about 800 seconds and the amplitude is about 1-2 Hz | 2 |
| UW-8 | 1 | Amplitudes are greatest between 750(s) and 1200(s). | 3 |  | NA |
| UW-9 | 1 | time 60 seconds frequency 25hz | 4 | time: 1000 seconds, frequency: 18hz | 3 |
| UW-10 | 1 | about 400 seconds with a frequency of 15 Hz | 4 | about 900 sec low frequency about 10 Hz | 3 |
| UW-11 | 1 | Time:750-2000, Frequency 2Hz | 2 |  | NA |
| UW-12 | 1 | time: ~750-1000s frequency: 2Hz | 2 | time: ~750, frequency: under 5Hz | 1 |
| UW-13 | 1 | 300 seconds, 30 Hz | 4 | time is about 750 s and frequency is about 20 Hz | 3 |
| UW-14 | 2 | 800 seconds, freq= 20 Hz | 3 | The approximate time is around 400 seconds, with a frequency of about 20 Hz. | 4 |
| UW-15 | 2 | 800 seconds, 2 Hz | 2 | The time is about 400 seconds and the frequency is 20 Hz. | 4 |
| UW-16 | 2 | 22Hz, Surface waves | 4 | happens at about 800 seconds and has a frequency of about 20 Hz | 3 |
| UW-17 | 2 | 850, 22hz | 3 | ~800s and 2Hz | 2 |
| UW-18 | 2 | Largest amplitude arrives between 800 and 1200 s | 3 | 800 s, 1 Hz | 1 |
| UW-19 | 2 | 400 seconds, 25 Hz | 4 | About 400 seconds with the arrival of the P waves, frequency of about 20 Hz | 4 |
| UW-20 | 2 | Around 400 seconds and 25 Hz (primary wave) | 4 |  | NA |
| UW-21 | 2 | 800 s 9 Hz | 3 | The largest amplitude arrives at approximately 800 s and has a frequency of approximately 1 Hz | 1 |
| UW-22 | 2 | 800s and Freq of 2Hz | 2 | Arrival is approximately at 900s. with a frequency around 1 Hz. | 1 |
| UW-23 | 2 | Approx 20 Hz at time = 400 | 4 |  | NA |
| UW-24 | 2 | ~350 hz, 11 s | 4 | ~35-60 s, ~25 Hz | 4 |

* 1. Estimate the frequency range with the most energy for this event.

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| **ID** | **Treatment** | **Pre- response** | **Pre- Rank** | **Post- response** | **Post- Rank** |
| UW-1 | 1 | 10 seconds, frequency ~25Hz | 6 |  | NA |
| UW-2 | 1 | Around 0-20 Hz | 4 |  | NA |
| UW-3 | 1 | 0-7 Hz | 3 | approximately 0.5-1 Hz. | 2 |
| UW-4 | 1 | 400-300 | 6 | 5 => 22 | 6 |
| UW-5 | 1 | 0-400Hz | 5 |  | NA |
| UW-6 | 1 | 0-2.5 hz | 1 | 750-1000 seconds | 6 |
| UW-7 | 1 | 0-10 Hz | 3 | The most energy occurs in the band of 0-2 Hz | 1 |
| UW-8 | 1 | Approximately between 2 and 15 Hz. | 5 |  | NA |
| UW-9 | 1 | 0 -10 hz | 3 | 0-10hz | 3 |
| UW-10 | 1 | 0-25 Hz | 4 | 15-25 Hz | 5 |
| UW-11 | 1 | 0-5Hz | 2 |  | NA |
| UW-12 | 1 | 0-5 Hz | 2 | ~0-3Hz | 1 |
| UW-13 | 1 | 0-20 Hz | 4 | About 1 Hz | 3 |
| UW-14 | 2 | 0-25 Hz | 4 | 0 Hz - 3.5 Hz | 1 |
| UW-15 | 2 | 0-20 Hz | 4 | 0-20 Hz | 4 |
| UW-16 | 2 | 0-8Hz | 3 | about 0-5 Hz | 2 |
| UW-17 | 2 | 0-25hz | 4 | frequencies 2Hz and below | 1 |
| UW-18 | 2 | 2 to 15 Hz | 2 | 0 - 1 Hz, maybe even 0 - 1.5 Hz | 1 |
| UW-19 | 2 |  | 5 | About 800 seconds with the arrival of the surface waves, low frequency (less than 3 Hz) | 6 |
| UW-20 | 2 | 20 to 30 Hz | 5 |  | NA |
| UW-21 | 2 | 6 to 22 Hz | 5 | The most energetic part of this event has a frequency range from 0 Hz to 25 Hz | 4 |
| UW-22 | 2 | 0-25Hz | 4 | Frequency range with the most energy is 0-2Hz. | 1 |
| UW-23 | 2 | 0-10 Hz | 3 |  | NA |
| UW-24 | 2 | 0-10 | 4 | ~5-20 Hz | 5 |

* 1. What frequency range is the background noise?

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| **ID** | **Treatment** | **Pre- response** | **Pre- Rank** | **Post- response** | **Post- Rank** |
| UW-1 | 1 | 0-5 Hz | 1 |  | NA |
| UW-2 | 1 | Around 0-5 Hz | 1 |  | NA |
| UW-3 | 1 | 0-4 Hz | 1 | 3-5 Hz | 3 |
| UW-4 | 1 | 100-200 | 6 | 0 => 5 | 2 |
| UW-5 | 1 | 0-5Hz | 1 |  | NA |
| UW-6 | 1 | 5-10 hz | 4 | 4-7 Hz | 4 |
| UW-7 | 1 | 0-4 Hz | 1 | The background noise is in the band of 1-3 Hz | 2 |
| UW-8 | 1 | Background noise is between 0 and 5 Hz. | 1 |  | NA |
| UW-9 | 1 | 0 -5 hz | 1 | 10-20hz | 5 |
| UW-10 | 1 | 0-5 Hz | 1 | about 3 hz | 3 |
| UW-11 | 1 | 5-10Hz | 4 |  | NA |
| UW-12 | 1 | 0-5Hz | 1 | under 5 Hz | 1 |
| UW-13 | 1 | 5-40 Hz | 5 | About 5 Hz to 40 Hz | 5 |
| UW-14 | 2 | about 10 Hz or so | 5 | 0 Hz - 5 Hz | 1 |
| UW-15 | 2 | 5 Hz | 4 | About 3 Hz | 3 |
| UW-16 | 2 | about 0-5Hz | 1 | about 0-2 Hz | 1 |
| UW-17 | 2 | 0-5hz | 1 | frequencies below 6Hz | 1 |
| UW-18 | 2 | 0 - 2 Hz | 1 | majority 0 - 3 Hz, full range about 0 - 5 Hz | 1 |
| UW-19 | 2 | 0-7 Hz | 1 | Below 4 Hz | 1 |
| UW-20 | 2 | 0 to 10 Hz | 2 |  | NA |
| UW-21 | 2 | 0 to 6 Hz | 1 | The background noise has frequencies between 0 and 8 Hz. | 1 |
| UW-22 | 2 | 0-7Hz | 1 | Except for the P wave arrival, Frequecy noise appears to be above 5Hz. | 4 |
| UW-23 | 2 | 0-1.5 Hz | 1 |  | NA |
| UW-24 | 2 | ? | 6 | ~8Hz | 4 |



1. Figure 2a, 2b and 2c is derived from the same seismic data shown in Figure 1. Please use these figures to describe the filter that would produce this image from the raw data.

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| **ID** | **Treatment** | **Pre- response** | **Pre- Rank** | **Post- response** | **Post- Rank** |
| UW-1 | 1 | No background noise | 5 |  | NA |
| UW-2 | 1 | Unknown | 7 |  | NA |
| UW-3 | 1 | removal of background noise | 5 | 5 Hz high pass filter | 2 |
| UW-4 | 1 | one that cancels background noise | 5 | low | 6 |
| UW-5 | 1 | removed surface waves | 5 |  | NA |
| UW-6 | 1 | I do not know | 7 | A high pass filter | 3 |
| UW-7 | 1 | One that filters out surface waves and background noise | 5 | High pass filter | 3 |
| UW-8 | 1 | A high-pass filter would filter the lower frequencies (background noise) and leave us with this image. | 3 |  | NA |
| UW-9 | 1 |  | 7 | band | 6 |
| UW-10 | 1 | a filter that removes data in the frequencies of the background noise | 5 | high pass filter that filters out frequencies below 3 Hz | 1 |
| UW-11 | 1 | Frequency filter | 6 |  | NA |
| UW-12 | 1 | filter on the frequency? | 6 | high pass | 3 |
| UW-13 | 1 | Background Noise Removed | 5 | low pass | 6 |
| UW-14 | 2 | A filter that cut out background noise and surface waves- it looks like the only information shown is for the primary and secondary waves (less noise) | 5 | Low pass filter (a filter that screens out low frequencies) | 4 |
| UW-15 | 2 | No idea :( | 7 | High pass filter | 3 |
| UW-16 | 2 |  | 7 | high pass | 3 |
| UW-17 | 2 | background noise filter | 5 | high pass filter | 3 |
| UW-18 | 2 | not sure, maybe some sort of decaying sine function? | 7 | high pass filter, it is only displaying about 2 Hz up to 20 Hz | 1.5 |
| UW-19 | 2 | Filtering out background noise (frequencies below 7 Hz) | 2 | A low-pass filter that passes data above 3 Hz | 2 |
| UW-20 | 2 | A filter that gets rid of the background noise. | 5 |  | NA |
| UW-21 | 2 | A colorful one | 7 | High pass filter that removed frequencies below 2 Hz. | 1 |
| UW-22 | 2 | A filter that removes low frequency background noise | 3 | A high pass filter. | 3 |
| UW-23 | 2 | Reducing amplitude below approx 2.5 Hz | 1 |  | NA |
| UW-24 | 2 | ? | 7 | High pass filter | 3 |