

Directions for using Audacity:

Note: You can find many YouTube videos that explain how to use Audacity.

Plug the microphone into the computer and turn it on.

Start with a tuning fork as your first sound sample.

Open the program (should be under student apps; ask your instructor if you can't find it).

Click on the red circle at the top to start taking data; Button with square to stop. Take about a 4 second sample of a constant pitch and volume.

- 1) Select an interesting portion of the graph by dragging the cursor over it (it will be shaded when selected). Use the magnifying glass button to zoom in until you can see the waveform. Sketch or print the waveform. Does it look like a sine wave? Or some other kind of wave?
- 2) Now choose 'Plot Spectrum' from the Analyze menu. The graph is the Fourier Spectrum of the data. To get a sharper graph change the 'Axis' from linear frequency to log frequency and set the 'Size' to 2048 instead of 512. Use the cursor to find the frequency of the highest peak in the graph. Write down this frequency and the approximate size (in dB). How close is this frequency to the one stamped on the fork (they should be pretty close)?
- 3) Now use a different sound source at the same pitch as the tuning fork. How are the waveforms (step 1) for the two different sources playing (or singing) the same pitch similar? How are they different?
- 4) Plot the spectrum for this new source. How is Fourier spectrum different from the tuning fork? Use the cursor to find the frequencies of the first 5 or 6 peaks and write them down and their size. Do any of them match the tuning fork (the first one should if the instrument played the same note as the tuning fork)?
- 5) For this sample, click on 'audio track' and select 'spectrogram'. This is a wavelet transform or spectrogram of the data. A spectrogram shows how frequencies change over time. Frequencies are plotted along the vertical axis, time along the horizontal. Describe the spectrogram and state how it relates to the sound you heard.
- 6) Now take a sample of a sound that changes pitch during the sample (several notes, one after the other or maybe a whistle that descends in pitch). Select the whole sample with the cursor. Click on 'audio track' and select 'spectrogram'. Describe the spectrogram and state how it relates to the sound you heard.
- 7) Compare your results with those of other groups who have a different instrument than yours. How are their spectrograms different from your instrument?
- 8) A trumpet and a clarinet playing the same note (pitch) still sound different because their timbre is different. Explain why they have different timbre in terms of overtones.
- 9) Write a brief definition of each of the following: Fourier Analysis, Fourier Synthesis, spectrogram, harmonics, overtones, timbre.

Turn microphone off when done!!!!