HW4 Physics 321 Fall 2019
Use Octave unless otherwise specified. Show/document all work by creating complete, commented .m files. Copy any produced plots to a WORD file with appropriate comments. Email .m and WORD files to me.

1. For the fork_512.wav file (see earlier emails from me),
a) Try using the hanning windowing function to fft and fftshift it. Make a plot (horizontal axis real frequency in hertz) of a close up of the 512 Hz peak (say from 450 to 570 Hz).

b) figure out a way (there are many possible) to put the same sound in the middle of a longer vector (say, 5 times longer than the original sound). Now fft and fftshift it and compare the result with the above. Plot the two on a common graph in different colors. Note and explain the difference in the appearance of the wings of the peak. (Hint: look up what the Fourier Transform of a single square pulse is).

2. Here are values for x, and h (which I eyeballed from Chapter 6 of the DSP guide)
X 0,-1,-1.25,2,1.4,1.4,0.75,0,-0.6
H 1,-0.5,-0.25,-0.125
a) use Octave to make the x, and h. Plot them using bar(x) and bar(h) to convince yourself they are close to correct.
b) convolve x and h to get y. Is the y you get close to that in the DSP guide? If not, see if you can tweak the values of x (or h) to get closer.
c) convolve h and x and convince me that the result is the same as for b.

3. a) Generate a unit impulse response function that has an exponential tail (something like exp(-n/10) ). Make the response about 30 channels long.
b) Figure out how (there are many ways: if you understand this: A = rand(1,21)>.3 you can adapt it to your case) to populate an input vector of length 500 with unit impulses at random locations with an average spacing of about 20 indices.
c) Convolve the result of b) with the response of a). Plot the results and interpret.