In this assignment, you will reinforce what we did in lecture today regarding MATLAB's filter toolbox.

For each of the following questions, you will create a filter, create magnitude-phase plots for the filter and apply the filter to a signal. Follow these steps:

- Generate MATLAB code for filters using the filter design toolbox in the signal processing toolbox (***filterDesigner***).
- Create a filter object by calling the generated code.
- Use the DSP toolbox's version of ***freqz*** on the filter object. Make sure to include the sampling frequency in the function call as this is hardly mentioned in the documentation. For example, if $filter$ is a filter object, n is the number of points (you can use 1024) and fs is the sampling frequency, run $[H, f] = freqz(filter, n, fs)$. Note I use f instead of w since by including the sampling frequency, MATLAB scales the frequencies from $[0, \pi]$ to $[0, fs/2]$. Hence these frequencies have units of Hertz. Keep that in mind when including units in your plots and setting the axis limits.
- Create magnitude-phase plots akin to homework 6 except for the difference mentioned above regarding f.
- Apply the filter to the signal using ***filter***.
- Lastly, plot the Fourier Transform of the final result using ***fft*** and ***plot***. Refer to the notes for the proper way to use ***fft*** and obtain the proper scaling.

This may seem daunting, but with properly defined functions, you may only have to do most of the work once. However, I still want unique titles for plots (maybe pass in a string?).

1. Generate a signal that consists of a sum of sine waves of frequencies 1 to 50 kHz. Set t to be from 0 to 2 seconds, using an interval of 0.001s.

$$signal = \sum_{f=1}^{50000} \sin(2\pi f t)$$

2. Create a Butterworth lowpass filter with a sampling frequency of Fs = 100 kHz, a passband frequency of Fpass = 10 kHz, a stopband frequency of Fstop = 20 kHz, a passband attenuation of Apass = 5dB, and a stopband attenuation of Astop = 50dB.

3. Create a Chebychev I highpass filter with a sampling frequency of Fs = 100 kHz, a passband frequency of Fpass = 35 kHz, a stopband frequency of Fstop = 15 kHz, a passband attenuation of Apass = 2dB, and a stopband attenuation of Astop = 40dB.

4. Create a Chebychev II bandstop filter with a sampling frequency of Fs = 100 kHz, a passband frequency of below the frequency Fpass1 = 5 kHz and above Fpass2 = 45 kHz, a stopband frequency of between Fstop1 = 15 kHz Fstop2 = 35kHz, a passband attenuation of Apass = 5dB, and a stopband attenuation of Astop = 50dB.

5. Create a Elliptic bandpass filter with a sampling frequency of Fs = 100 kHz, a stopband frequency of below the frequency Fstop1 = 15 kHz and above Fstop2 = 35 kHz, a passband frequency of between Fpass1 = 20 kHz Fpass2 = 30 kHz, a passband attenuation of Apass = 5dB, and a stopband attenuation of Astop = 50dB.