Program Assignment # 3, EE5350

1. Write a function called Signal which can produce a signal, S, defined as

$$S(w,n) = n \cdot \exp(-n/6.) \cdot \cos(w \cdot n)$$

for n between 0 and N_x. Signal S has the user-chosen parameter *w*.

2. Write a function called DSINE, with user-chosen parameter w_c, which designs a lowpass moving average filter digital filter by calculating N from w_c. This filter is to be implemented recursively. FYI:
(a) A very similar filter is covered in lecture notes IV pages 5-8.
(b) The cut-off frequency could be the frequency at which $H(e^{jw}) = 0$.

3. Write a function called AMP, with parameters A_m, w, N_m, x, and N_x, which calculates the amplitude response of x as

$$w(k) = \frac{\pi \bullet k}{N_m}$$

$$Z = e^{j \bullet w(k)}$$

$$A_m(k) = \left| \sum_{n=0}^{N_X} x(n) \bullet Z^n \right|$$

for k= 0 to N_m. This function should have the format [Am,w] = Amp(Nm,x,Nx)

4. Do the following;
(a) Using Signal, generate an input signal x(n) = S(.2,n) + S(1.3,n) + S(2.5,n) with N_x=100. Use Amp to calculate the amplitude spectrum of x(n) for N_m=100. Plot x(n) and its amplitude response.

(b) Using Dsine, design a filter which passes S(.2,n) but approximately rejects the other two components of x(n). Calculate the impulse response h(n) using the difference equation . Plot h(n) and the amplitude response of the filter.

(c) Calculate the filtered signal y(n) using a difference equation. Plot y(n) and its amplitude spectrum, with N_m=100.

5. Turn in the program listings, as well as the 6 plots.