EE 311 **Name_____**
Hour Exam 1 **February 3, 2017**

1. A digital filter is found to have an impulse response of
h(nT) = {0.5, 0.75, 1.0, 0.5, 0, 0, 0, …}
What will be the gain of a d.c. signal input to this system?

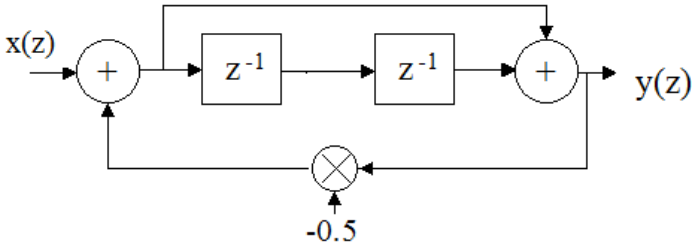
2. Consider an ideal integrator.
   a) If a unit impulse is applied to the input of an ideal integrator what is the response?

   b) Use the results of part a to find the z-transform for the transfer function for an ideal integrator.

3. Use a convolution table (in reverse) to determine the impulse response of a DSP system if the step response is given by y(step) = {0.5, 1.5, 1.0, 1.0, 1.0, …}

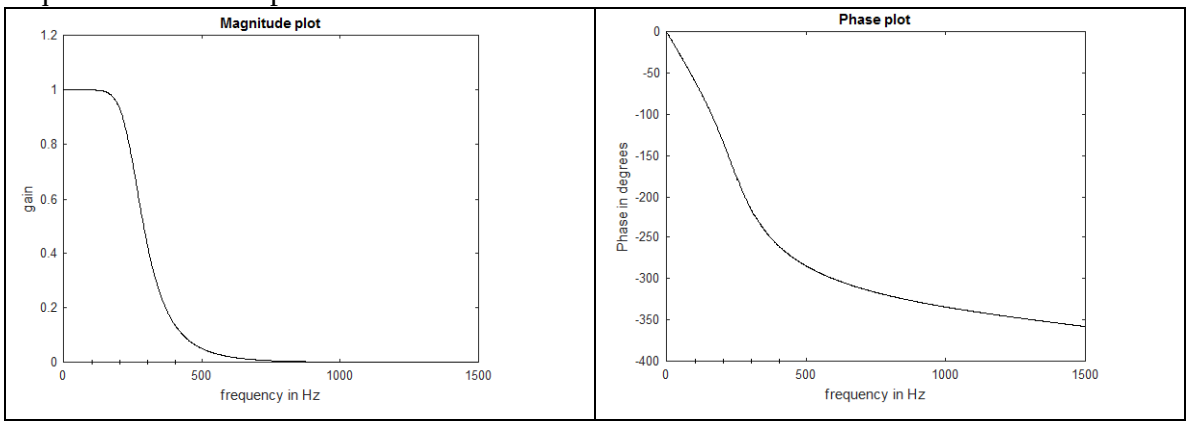
4. The following difference equation represents a non-causal system. Find the transfer function for the difference equation and verify that the numerator is of higher order than the denominator. $y_n = x_n - 0.2x_{n+1} + 0.6x_{n+2} - y_{n-1} + 0.2y_{n-2}$

5. Find the transfer function in z for the system shown below.



6. For the sinusoid given by $y(t) = 3.5\sin(1000\pi t + \pi/4)$
Find the three lowest frequencies that will alias this signal if the sampling frequency is 4 KHz.

7. The figures below show the magnitude and phase plot of a low pass filter which has a sample frequency of 3 KHz. If the input to the filter is $x = 3\sin(600\pi)$ x write the equation for the output sinusoid.



8. The system below has a feedback term K which is a constant. Answer the following questions:

A) Does this system represent an IIR or an FIR filter? Justify your answer.

B) Find the transfer function for the system below in terms of K_1 and K_2.

C) Find the range of values of K_1 and K_2 for which the system is stable.