ECE 376 - Homework #11

z-Transforms and Digital Filters. Due Monday, December 1st

1) Assume X and Y are related by the following transfer function

$$Y = \left(\frac{20(s+2)}{(s+1)(s+3)(s+10)} \right) X$$

a) What is the differential equation relating X and Y?

b) Find y(t) assuming

$$x(t) = 2 + 4\sin(3t)$$

2) Assume X and Y are related by the following transfer function

$$Y = \left(\frac{0.2(z+1)}{(z-0.98)(z-0.96)} \right) X$$

a) What is the difference equation relating X and Y?

b) Find y(t) assuming a sampling rate of T = 0.01 second

$$x(t) = 2 + 3\sin(4t)$$

Problem 3) Assume G(s) is a low-pass filter with real poles:

$$G(s) = \left(\frac{1000}{(s+3)(s+7)(s+20)} \right)$$

3) Design a digital filter, G(z), which has approximately the same gain vs. frequency as G(s). Assume a sampling rate of T = 0.01 second.

Plot the gain vs. frequency for both filters from 0 to 50 rad/sec.

Problem 4) Assume G(s) is the following band-pass filter:

$$G(s) = \left(\frac{6s}{(s+3+j20)(s+3-j20)} \right)$$

Design a digital filter, G(z), which has approximately the same gain vs. frequency as G(s). Assume a sampling rate of T = 0.01 second.

Plot the gain vs. frequency for both filters from 0 to 50 rad/sec.

Problem 5) Write a C program to implement the digital filter, G(z)