ECE 376 - Homework #11

z-Transforms and Digital Filters. Due Wednesday, April 20th

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

$$Y = \left(\frac{10(s+3)}{(s+2)(s+7)}\right)X$$

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

b) Find y(t) assuming

$$x(t) = 2 + 4\sin(5t)$$

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

$$Y = \left(\frac{0.01(z+1)}{(z-0.98)(z-0.92)}\right)X$$

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

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

$$x(t) = 2 + 4\sin(5t)$$

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

$$G(s) = \left(\frac{90}{(s+2)(s+4)(s+10)}\right)$$

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:

$$G(s) = \left(\frac{6s}{(s+1+j16)(s+1-j16)}\right)$$

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)