HW3 ECE2100 Autumn 2014

Lessons Covered: Lecture38 - Lecture39
HW should be turned in by Monday, Oct. 6, before 4:30pm

Solve all the problems. All problems will not be graded, only a selection of HW problems will be graded.

Show all relevant steps. Don’t just write down the answers.

Late HWs will not be accepted. HW with lowest grade will be dropped. Lecture Students: turn in your HW in class. Recitation students: turn in your HW at the ECE Office Front Desk. HWs turned-in anywhere else will not be accepted.

Show your work on these pages, attach additional pages if necessary.

• Be sure to organize the pages in order and staple them all together, otherwise you will lose one point

• Fill out the following section. You will lose an additional point if you fail to provide these details

Your Last Name_____________________________
Your First Name_____________________________

1. Lecture Student __________ or Recitation Student________ (check one)  
2. If Recitation then fill out the following  
   Name of recitation instruction____________________ Date/time of recitation____________
3. Your Lab Section/Group__________________________________

Problem 1: Determine the System Function $H(z)$ corresponding to the following difference equation:

$$y[n] = y[n-1] - 0.5y[n-2] + x[n] + 0.5x[n-1]$$
Problem 2: Find the poles and zeros of the System Function found in Problem 1. Plot the poles and zeros on the z plane. Which poles and zeros are trivial?
**Problem 3:** Analytically, determine the magnitude Frequency response corresponding to the difference equation of Problem 1.

**Problem 4:** Use MATLAB to plot the Magnitude Frequency Response evaluated in Problem 3 vs. the normalized frequency (units: cycles/sample). Is this system a Low Pass or High Pass filter, and why? Staple your MATLAB code and the plot to this HW right after this page.
Problem 5: Use MATLAB to plot the Magnitude Frequency Response of the system described by the difference equation in Problem 1 by using the freqz function of MATLAB (see Page 15 of Lecture39). Compare your result with the plot obtained in Problem 4. Staple your MATLAB code and plot to this page of the HW.
Problem 6: Determine the System Function $H(z)$ corresponding to the following poles and zeros:
Problem 7: Determine the Difference Equation corresponding to the poles and zeros of Problem 6:
Problem 8: Analytically determine the Magnitude Frequency Response of the system corresponding to the following difference equation (your answer will depend on $p$ and $b_0$):

$$y[n] = 2p y[n-1] - p^2 y[n-2] + b_0 x[n]$$

$0 < p < 1$, $b_0 > 0$
Problem 9: Determine the bandwidth of the filter given in Problem 8 in terms of $p$. 
... page for Problem 9
Problem 10: For the difference equation given below, use the poles and zero to demonstrate why a positive value of p gives us a low pass filter and a negative value of p gives us a high pass filter.

\[ y[n] = 2p y[n-1] - p^2 y[n-2] + x[n] \]