EE 341 - Homework 3

Due September 14, 2005

For problems which require MATLAB, please include a MATLAB m-file which shows how you made your plots.

1. For the difference equations given below, find the $y[n]$ for $n = 0$ to 4. Do this by hand.

   (a) $y[n] = 0.5y[n-1] + x[n-1]$; $x[n] = u[n]$; $y[-1] = 0$.

   (b) $y[n] = 2y[n-1]$; $y[-1] = 1$.

   (c) $y[n] = 0.25y[n-1]+0.125y[n-2]+x[n]+0.25x[n-1]$; $x[n] = u[n]$; $y[-1] = 1$, $y[-2] = -1$.

   (d) $y[n] = y[n-1] - 0.25y[n-2] + x[n] - x[n-2]$; $x[n] = \delta[n]$; $y[-1] = 0$, $y[-2] = 0$

   (e) $y[n] = -0.25y[n-2] + x[n]$; $x[n] = 0$; $y[-1] = 1$, $y[-2] = 1$

2. For the difference equations from Problem 1, use the *recur* function (on page 69 of the text, or download it from the textbook website) to find $y[n]$ for $n = 0$ to 10. Plot $y[n]$ using the `stem` function of MATLAB. Verify that the results for the first few values match those you found in Problem 1.

3. Using the techniques in the class handout, find a closed-form equation for $y[n]$ for the difference equations in Problem 1. Use MATLAB to find and plot $y[n]$ for $n = 0$ to 10. Verify that the results match those of Problem 2.

4. Consider the difference equation

   $$y[n] = y[n-1] + y[n-2] + x[n-1]$$

   with $x[n] = \delta[n]$ and $y[-1] = 0$, $y[-2] = 0$.

   (a) Show that this difference equation gives the Fibonacci sequence 0, 1, 1, 2, 3, 5, 8, 13, $\cdots$, where a term is equal to the sum of the previous two terms.

   (b) Using the techniques in the class handout, find a closed-form equation for $y[n]$.

   (c) Use the equation from (b) to verify the $y[50] = 12586269025$.