ECE 320 SIGNALS AND SYSTEMS II
Problem Set 4
Fall 2002

Issued: Thursday, September 19, 2002
Due: Monday, September 30, 2002

Reading in Oppenheim and Willsky with Nawab
9/23/02 — Section 3.4-3.5
9/25/02 — Sections 3.6-3.7
9/30/02 — Sections 3.8-3.11

Problem ECE320-5  (started in class on 9/16)
Consider the causal LTI system described by the following difference equation:

\[ y[n] + \frac{3}{2} y[n - 1] - y[n - 2] = x[n]. \]

(a) What is the form of the homogeneous solution?

(b) Let \( x[n] = u[n] \). What is the particular solution?

(c) Assuming \( x[n] = u[n] \), state the auxiliary conditions. (Remember: the system is causal and LTI.)

(d) What is \( y[n] \) when \( x[n] = u[n] \)?

(e) Determine the impulse response of this system. Is this system IIR or FIR?

(f) Use the filter command to check your results for parts d and e. Your writeup for this part should include the plots of \( x[n] \) and \( h[n] \), along with the Matlab code you used to produce them. Note that you will have to choose a reasonable interval for plotting the output of filter. (The analytical results may be infinite length, but you can only plot a finite number of points using Matlab.)

Your Matlab book (Computer Explorations in Signals and Systems Using Matlab by Buck, Daniel, and Singer) has a nice tutorial about filter in Section 2.2. The main information you’ll need is on pages 22 and 23. You do not have to turn in the tutorial exercises.

Problem 3.22 in Oppenheim/Willsky/Nawab
Part a – find the Fourier series representation for the signal in Figure P3.22d only (i.e., the periodic signal with the impulses in it).

Problem ECE320-6
Find the Fourier series representation for the signal \( x(t) \) with period 2 given below:

\[ x(t) = e^{-t} \quad \text{for} \quad -1 < t < 1 \]

Problem 3.24 in Oppenheim/Willsky/Nawab
Problem 3.28 in *Oppenheim/Willsky/Nawab*
Part a – find the Fourier series for the signal shown in Figure P3.28a only.

**Problem ECE320-7**
Consider a periodic signal $x[n]$ with period $N = 4$. It’s Fourier series coefficients are:

\[ a_0 = 1 \quad a_1 = 2 \quad a_2 = 0 \quad a_3 = 2 \]

Determine and sketch the signal $x[n]$. 