CMPE323 Signals and Systems Fall 2016
Homework #2 Assigned 9/14/2016, **Due 9/21/2014 at start of 11 AM discussion**

Your Name Here
"CMPE323" Here
Due Date: Here

Rules for all homework:

1. $8\frac{1}{2}\times 11\ \text{paper, no perforations}$. (Not torn from spiral bound notebook) Lined, unlined, or grid is OK.
2. Name, date, and CMPE323 HW## on all assignments in upper right of first page.
3. You may write on both sides of paper. Include MATLAB code listings for MATLAB exercises and plotted output. You don't need to include MATLAB code if you just use MATLAB to sketch the required outputs.
4. Single staple in upper left. STAPLE – NOT FOLD! STAPLE – NOT PAPER CLIP! STAPLE!

Failure to follow these simple rules will result in a score of 0 for that homework.

NOTE THE DUE DATE!

CMPE323 HW02

In these problems (and in CMPE323 in general), $u(t)$ is the unit step function and $\delta(t)$ is the unit impulse. Some of the content may require the Monday, September 19 lecture.

1. Review (Nahvi, Chapter 1, Problem 20)
   Sketch the following function made of unit impulses. In each case determine if the function is even or odd. If it is neither, determine if a shift in time (in either direction) could make it even or odd.
   $a)\ \ \delta(t)-\delta(t-1)$
   $b)\ \ -2\delta(t)+2\delta(t-1)$
   $d)\ \ \delta(t+1)-\delta(t-1)$
   $g)\ \ -\delta(t+2)-\delta(t+1)+4\delta(t)+4\delta(t-1)+\delta(t-2)+\delta(t-3)$

2. Mathematical Description of Systems. (LaBerge)
   For each of the following descriptions of the output ($y(t)$) in terms of the input $x(t)$, determine if the system is Linear, Time Invariant, Causal.

Your Name Here
"CMPE323" Here
Due Date: Here

$a)\ y(t) = -2x^2(t) + 1$

$b)$ The affine system: $y(t) = 5x(t) + 1$

$c)$ A compressor: $y(t) = x(5t)$

$d)$ An expander: $y(t) = x(0.2t)$

$e)$ A two-dimensional system: $y(t) = 3x_1(t) + x_2(t)$. Hint, treat the input as a 2 element column vector and write a matrix equation for the output. Then analyze as usual.

$f)$ An integrator: $y(t) = \int_{-\infty}^{t} x(\tau)\,d\tau$; assume that the integral is well defined

$g)$ A differentiator: $y(t) = \frac{dx(t)}{dt}$; assume that the derivative is well defined

$h)$ A future integrator: $y(t) = \int_{t}^{\infty} x(\tau)\,d\tau$

3. (Nahvi, Chapter 3, Problem 25)
   The response of an LTI system to a unit amplitude square pulse of duration, $d(t) = u(t) - u(t-1)$ is $0.5^t u(t)$. Find the response of this system to

   $a) x_2(t) = d(0.5t)$

   $b) x(t) = \sum_{n=0}^{\infty} (-1)^n x_2(t-n)$. Is this system causal?

   Use MATLAB to plot $x(t)$ by plotting an estimate of the infinite sum and the analytical form you derived in b). Show that the plots match. (Code need not be turned in).

4. Modified Nahvi, Chapter 3, Problem 30
   The unit impulse response of an LTI system is $h(t) = -e^{-(t+1)}u(t+1)$. Find its response to $x(t) = 1.6u(t) - 0.6u(t-1)$. Is this system causal?

   Repeat the problem for $h(t) = (1 - e^{-t})u(t)$.