CMPE323 Signals and Systems Fall 2016

Homework #1 Assigned 9/7/2016, **Due 9/14/2014 at start of 11 AM discussion**

Your Name Here

"CMPE323" Here

Due Date: Here

Rules for all homework:

1. $8\frac{1}{2}\times 11$ 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 HW01

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 12 lecture.

1. MATLAB Practice

   (a) Generate the signal $y(t) = 2\cos(2\pi t)$ over the interval $0 \le t < 10$ in increments of 0.005 seconds.

   (b) Find the average value of $y(t)$ using three different MATLAB methods, without using the built-in MATLAB functions `sum` and `mean`. *Hint*: *One method is inefficient, two are not.*

   (c) Estimate the integral $\int_0^t y(\tau)\,d\tau;\ \ 0 \le t < 10.$ directly from the values generated in (a).

   (d) Estimate the derivative $\frac{dy}{dt};\ 0 \le t < 10$ directly from the values generated in (a). *Hint: Investigate the MATLAB function* `diff`.

   (e) Create a MATLAB plot that shows the results of (a), (c), and (d) as a function of the time variable, t , on three difference axes. Label the y-axis in each case, and provide titles for each of the plots.

2. (Jackson, Problem 2.1)

   Sketch and label each of the following continuous time systems (MATLAB plots are OK as sketches, but not required). Hand sketches should be labeled and to scale.

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$$a) x(t) = 2u(t) - u(t-1), \text{ and } \frac{dx}{dt}.$$

$$d) x(t) = \delta(t+\pi) - 2\delta(t-\pi), \text{ and } \int_{-\infty}^{t} x(\tau)\,d\tau.$$

$$f) x(t) = \sum_{k=-\infty}^{\infty} \delta(t-kT)$$

3. (Jackson, Problem 2.3)

Evaluate the following integrals and indicate if the result is a function of time or a constant.

$$a) \int_{-\infty}^{t} \cos(\tau)u(\tau)\,d\tau$$

$$b) \int_{-\infty}^{t} \cos(\tau)\delta(\tau)\,d\tau$$

$$c) \int_{-\infty}^{\infty} \cos(\tau)\delta(\tau)\,d\tau$$

$$d) \int_{-\infty}^{t} \cos(\tau)u(\tau-1)\delta(\tau)\,d\tau$$

$$e) \int_{0}^{2} \left[e^{(\tau^2-3\tau+2)}\right]\delta(\tau-1)\,d\tau$$

$$f) \int_{0}^{2} \left[e^{(\tau^2-3\tau+2)}\right]\delta(\tau+1)\,d\tau$$

4. (LaBerge)
Create a MATLAB script that does the following. Define an autonomous function to be a unit amplitude pulse of during T, as in Lab 0. Using this unit pulse, create and then plot the following six variations. Use T = 1.5 for the duration of your pulse, and compute /plot over the range of times -5 to +5. Include the plots and your script with your homework.

   a) Delay the pulse by 3 seconds.
   b) Advance the pulse by 2.5 seconds.
   c) Compress the time scale by a factor of 2.
   d) Expand the time scale by a factor of 2.
   e) Reverse the time time scale.
   f) Generate and plot the pulse $p(-0.2t+1)$