GEORGIA INSTITUTE OF TECHNOLOGY
School of Electrical and Computer Engineering

EE3230
Problem Set No. 1

Date Assigned: April 3, 1998
Date Due: April 10, 1998

Reading Assignment: In Oppenheim and Willsky, read pp. 7-56 and pp. 90-116.

Homework Assignment: In all problems, write some explanation of your approach to the solution, i.e., give more than the answer. Turn in for grading only the starred problems: 1.3*, 1.6*, 1.8*, 1.9*, and 1.10*. Unstarred problems are from Problem Set No. 1 of last quarter. Solutions are on the web page. Problems 1.8*, 1.9*, and 1.10* are quiz problems from last quarter.

Review Problems:
Take a look at Problems 1.1, 1.2, and 1.52 in Oppenheim and Willsky.

Problem 1.1:
Work Problem 1.21 (a), (b), (c), (e), and (f) in Oppenheim and Willsky.

Problem 1.2:
Work Problem 1.27 (a), (c), (f), and (g) in Oppenheim and Willsky.

Problem 1.3*:
Work Problem 1.27 (b), (d), and (e) in Oppenheim and Willsky.

Problem 1.4:
Work Problems 2.8 and 2.11 in Oppenheim and Willsky.

Problem 1.5:
Work Problem 2.22 (a) in Oppenheim and Willsky.

Problem 1.6*:
Work Problem 2.29(c) , (d), and (e) in Oppenheim and Willsky.

Problem 1.7:
Work Problem 2.44(d) in Oppenhem and Willsky.

Problem 1.8*:

A linear time-invariant system is described by the following equation:

$$y(t) = \int_{-\infty}^{t+2} x(\tau)d\tau$$

(a) Determine the impulse response of the system; i.e., determine an expression for $y(t) = h(t)$ when the input is $x(t) = \delta(t)$.

(b) Plot $h(t)$.

(c) Is the system stable? Justify your answer.

(d) Is the system causal? Justify your answer.

Problem 1.9*:

A linear time-invariant system has impulse response

$$h(t) = \begin{cases} e^t & 2 < t < 4 \\ 0 & \text{otherwise} \end{cases}$$

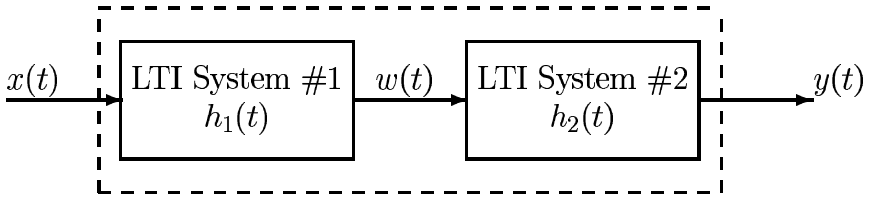
The input to this system is

$$x(t) = \begin{cases} 1 & -1 < t < 0 \\ 0 & \text{otherwise} \end{cases}$$

(a) For what values of t is it true that $y(t) = 0$? *Draw a carefully labelled sketch to help solve this problem.*

(b) Determine $y(t)$ for all t and plot it.

Problem 1.10*:



The first system is described by the input/output relation

$$w(t) = \frac{dx(t)}{dt}$$

and the second system has impulse response

$$h_2(t) = e^{-2t}u(t) - e^{-6}e^{-2(t-3)}u(t-3) = e^{-2t}[u(t) - u(t-3)]$$

(a) Make a carefully labelled sketch of $h_2(t)$.

(b) Find the impulse response of the overall system; i.e., find the output $y(t) = h(t)$ when the input is $x(t) = \delta(t)$.

(c) Plot $h(t)$.