Assignment #04

ECSE-2410 Signals & Systems - Spring 2011 Due Tues 02/08/11

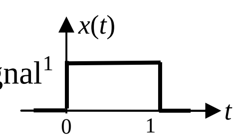
1(20). Is the system

(a) $y(t) = |x(t)|$ linear? Verify your answer.

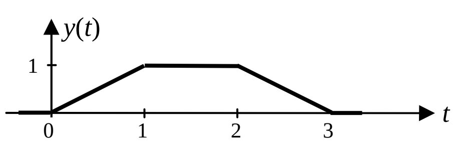
(b) $y(t) = e^{x(t)}$ time-invariant? Verify your answer.

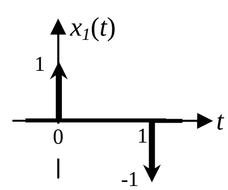
2(15). Use Laplace transforms to **verify** the time-invariance property of LTI systems. Suppose an input signal $x(t)$ generates an output $y(t)$ according to the system input-output relationship $Y(s) = H(s)X(s)$. Now assume a signal $x_1(t) = x(t - t_0)$, is applied to the system. **Verify** that the resulting output signal is $y_1(t) = y(t - t_0)$.

3(15). The lecture notes showed that for a LTI system, $Y(s) = H(s)X(s)$, flipping the input, i.e., letting $x_1(t) = x(-t)$ does not imply that the output is flipped, i.e., $y_1(t) \neq y(-t)$. Suppose we flip the input $x_1(t) = x(t)$ and run the system backwards so that the impulse response becomes $h_1(t) = h(-t)$. Is the resulting output flipped in this case, i.e., is the resulting output $y_1(t) = y(-t)$? **Verify** your answer using Laplace transforms.

4(15). When the signal 

is applied to an LTI system,

its output is 

Sketch the output $y_1(t)$ of this system when the input is 

5(20). Find the impulse response of a filter whose transfer function is $H(s) = \dfrac{2(s+1)^2}{s(s+2)}$.

6(15). Evaluate the convolution, $c(t) = a(t) * b(t)$, where $a(t) = 2e^{-2t}u(t)$ and $b(t) = e^{-t}u(t)$, i.e., find $c(t)$. Use Laplace transforms.