University of Portland
School of Engineering

EE 262-Signals & Systems-3 cr. hrs.
Spring 2012

Midterm Exam # 2

(Prepared by Professor A. S. Inan)

(Friday, March 30, 2012)

Name:_____ ☺

Signature:_____ ☺

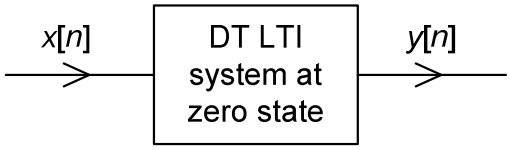
"Honesty is the best policy."
Aesop (~ 620B.C. –?)

"An honest mind possesses a kingdom."
Lucius Annaeus Seneca (4B.C.–65A.D.)

"Honest people are the true winners of the universe."
Anonymous

Select and do any 4 of the 5 problems assigned during class time. The fifth problem is a take-home problem due class time on Monday, April 3, 2012.

(1) (Total: 20 points). **DT LTI system.** The unit impulse of a DT LTI system is provided below as shown. An input signal $x[n] = 3\delta[n-1] - 2\delta[n-3]$ is applied to this system.

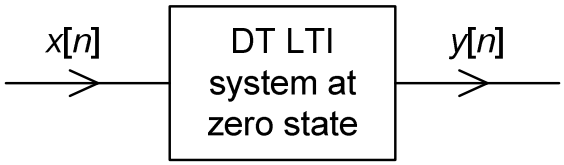


$h[n] = 3u[n] + 4\delta[n-1] - 3\delta[n-2] - 3u[n-5]$

(a) (8 points) Sketch both signals $x[n]$ and $h[n]$. Provide all the pertinent values on the sketch.

(b) (12 points) Find and sketch the zero-state response $y_{zs}[n]$ of this system.

(2) (Total: 20 points) **LTI system.** Consider the following DT LTI system with its impulse response provided as shown.

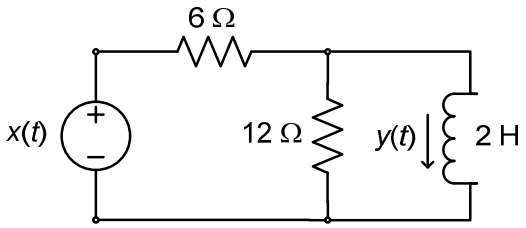


$$h[n] = 2\delta[n] - 5\delta[n-1] + 3\delta[n-5]$$

(a) (10 points) Find and sketch the unit-step response of this system.

(b) (10 points) Find and sketch the zero-state response of this system due to $x[n] = 3u[n-2]$.

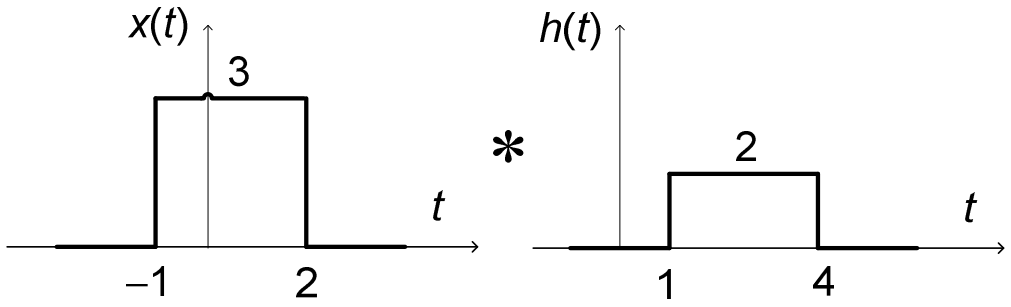
(3) (Total: 20 points) **Electric circuits.** For the electric circuit shown:



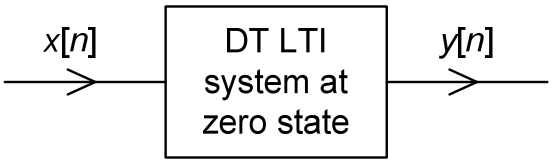
(a) (10 points) Find the unit-step response $y_S(t)$. Provide your work step by step. (Note that $y_S(t)$ represents the current of the inductor.)

(b) (10 points) Find the impulse response $h(t)$. Show your work.

(4) (20 points) **Convolution integral.** Find and sketch the function $y(t)$ obtained as a result of convolving the two signals shown below. Provide all the pertinent values on your sketch.



(5) (Total: 20 points) **LTI system.** The difference equation governing an LTI system is provided as shown.



$$y[n] - 0.5y[n-1] + 3x[n] = 0$$

(a) (10) Find the impulse response $h[n]$ of this system in its most general form.

(b) (10) Find the value of the sample of the unit-step response of this system at $n = 3$. (That is, find $y_s[3]$.)