

Islamic University of Gaza
Electrical Engineering Department
EELE 3310 Signals & Systems
Med-Term Exam
November 13, 2011

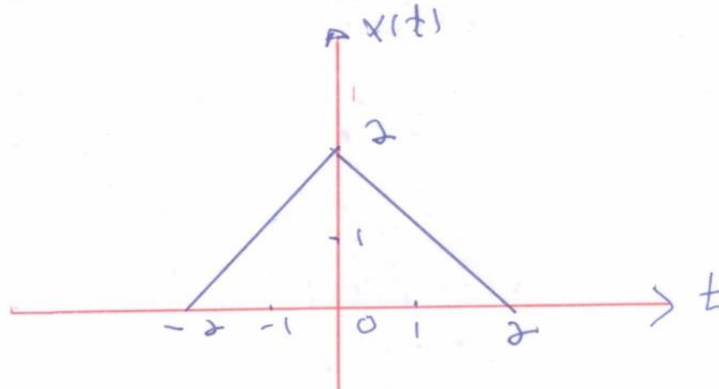


Dr. Basil Hamed
Name:

Exam Time 11:00-12:30
ID #

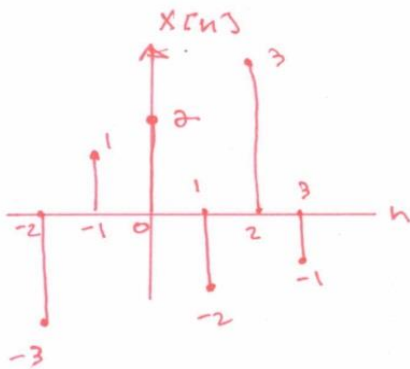
1. a) Plot the signal; $x(t) = r(t+2) - 2r(t) + r(t-2)$, where $r(t)$ is a ramp

(3 PT.)

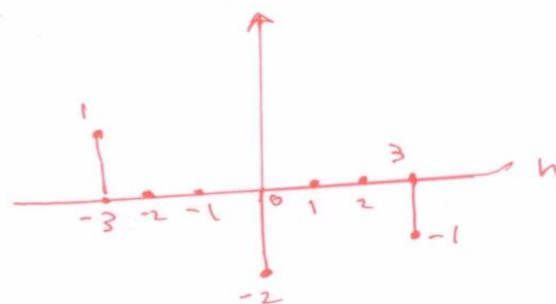


- b) Given $x[n] = \{-3, 1, 2, -2, 3, -1\}$ sketch $x[\frac{2}{3}n+1]$

(3 PT.)



$$x[\frac{2}{3}n+1]$$



$$n=0 \Rightarrow x[1] = -2$$

$$n=3 \Rightarrow x[3] = -1$$

$$n=-3 \Rightarrow x[-1] = 1$$

2.a) State with a brief explanation if the following system is linear/non-linear, causal/non-causal, time-invariant/time-varying, memory/ memoryless. (5 Pt.)

$$y[n] = n^2 x[n+2]$$

* Linear:

$$a y_1[n] + b y_2[n] = a n^2 x_1[n+2] + b n^2 x_2[n+2] = n^2 [a x_1[n+2] + b x_2[n+2]]$$

$\therefore$ system is Linear.

* Causal system is non causal depends on Future.

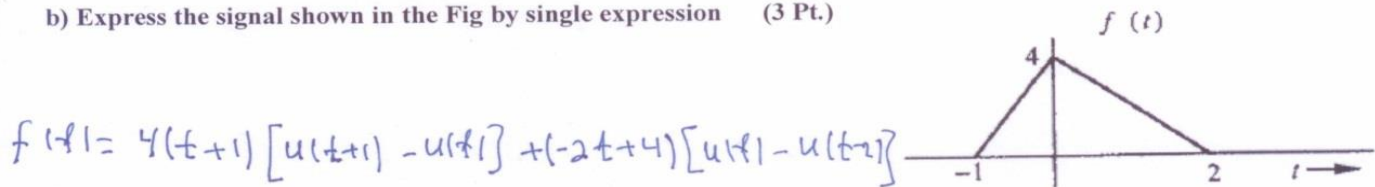
* Time Varying:

system is Time Varying multiplication by n^2

* Memory ~

system is memory because is not instantaneous.

b) Express the signal shown in the Fig by single expression (3 Pt.)



$$f(t) = 4(t+1)[u(t+1) - u(t)] + (-2t+4)[u(t) - u(t-2)]$$

$$f(t) = 4(t+1)u(t+1) - 6tu(t) + 3u(t) + (2t-4)u(t-2)$$

OR $f(t) = 4r(t+1) - 6r(t) + 2r(t-2)$

3) Consider the interconnection of the four LTI systems depicted below

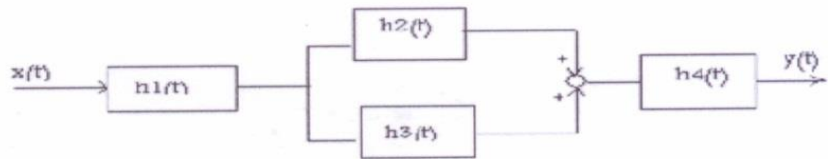
(6 PT.)

$$h_1(t) = e^{-2t} u(t+1)$$

$$h_2(t) = u(t-3)$$

$$h_3(t) = 2\delta(t)$$

$$h_4(t) = 3\delta(t-1)$$



a) Find the impulse response $h(t)$ of the equivalent system

$$h(t) = h_1(t) * (h_2(t) + h_3(t)) * h_4(t)$$

$$= e^{-2t} u(t+1) * (u(t-3) + 2\delta(t)) * 3\delta(t-1)$$

$$= e^{-2t} u(t+1) * (3u(t-4) + 6\delta(t-1))$$

$$h(t) = 3e^{-2t} u(t+1) * u(t-4) + 6e^{-2(t-1)} u(t)$$

$$3e^{-2t} u(t+1) * u(t-4) = \int_{-1}^{t-4} 3e^{-2\tau} d\tau = \frac{3}{2} [e^2 - e^{-2(t-4)}]$$

$$\therefore h(t) = \frac{3}{2} [e^2 - e^{-2(t-4)}] u(t-3) + 6e^{-2(t-1)} u(t)$$

b) Which of the systems H_1, H_2, H_3, H_4 are stable? Show your work

(4 Pt.)

$$① \int_{-1}^{\infty} e^{-2t} dt = \frac{1}{2} e^{-2t} \Big|_{-1}^{\infty} = -\frac{1}{2} e^2 \Rightarrow \text{stable}$$

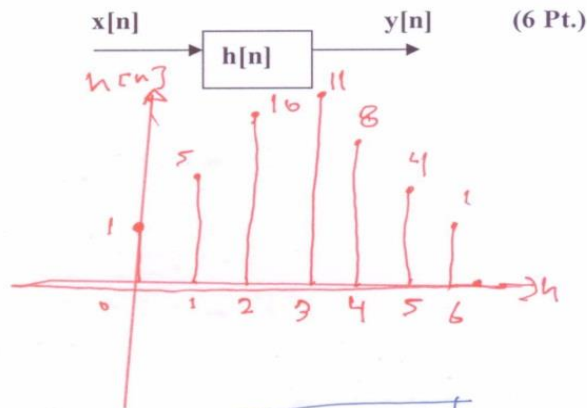
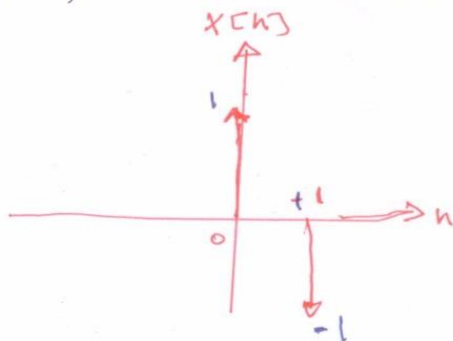
$$② \int_3^{\infty} 1 dt = \infty \Rightarrow \text{not stable}$$

$$③ \int_{-\infty}^{\infty} 2\delta(t) dt = 2 \Rightarrow \text{stable}$$

$$④ \int_{-\infty}^{\infty} 3\delta(t-1) dt = 3 \Rightarrow \text{stable}$$

4. Find $y[n]$ for given $x[n]$, and $h[n]$.

$$x[n] = \{1, -1\}, \quad h[n] = \{1, 5, 10, 11, 8, 4, 1\}$$



(6 Pt.)

$$x[n] = \delta[n] - \delta[n-1]$$

$$y[n] = x[n] * h[n] = (\delta[n] - \delta[n-1]) * h[n]$$

$$y[n] = h[n] - h[n-1]$$

$$\Rightarrow y[0] = h[0] - h[-1] = 1$$

$$y[1] = h[1] - h[0] = 5 - 1 = 4$$

$$y[2] = h[2] - h[1] = 10 - 5 = 5$$

$$y[3] = h[3] - h[2] = 11 - 10 = 1$$

$$y[4] = h[4] - h[3] = 8 - 11 = -3$$

$$y[5] = h[5] - h[4] = 4 - 8 = -4$$

$$y[6] = h[6] - h[5] = 1 - 4 = -3$$

$$y[7] = h[7] - h[6] = 0 - 1 = -1$$

