

Islamic University of Gaza
Electrical and Computer Engineering Department
EELE 3310 Signals & Systems
Med-Term Exam
November 8, 2006

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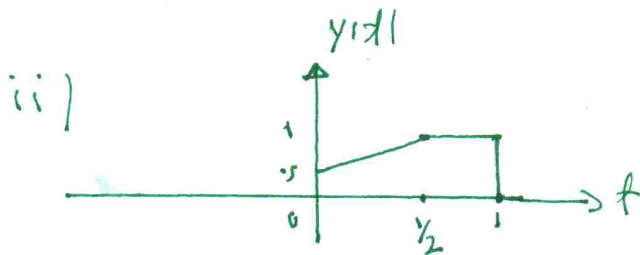
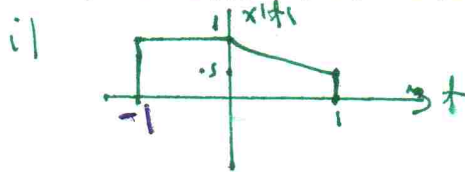
Exam Time 10:00-11:30

1. a-Consider the signal $x(t) = 2^{-tu(t)}$, where $u(t)$ is unit step function.

(3 Points)

i) Sketch $x(t)$ over $(-1 \leq t \leq 1)$

ii) Sketch $y(t) = x(1-2t)$ over $(-1 \leq t \leq 1)$



b- Express the signal shown in Fig. 1 in terms of elementary functions.

(3 Points)

$$t^2 [u(t-1) - u(t-2)] + (2t - 8) [u(t-2) - u(t-4)]$$

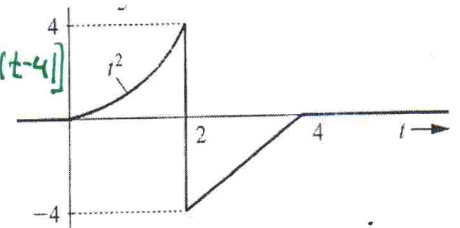


Fig. 1

OR

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

OR

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

c- Are the following signals periodic? If so, find their periods.

(4 Points)

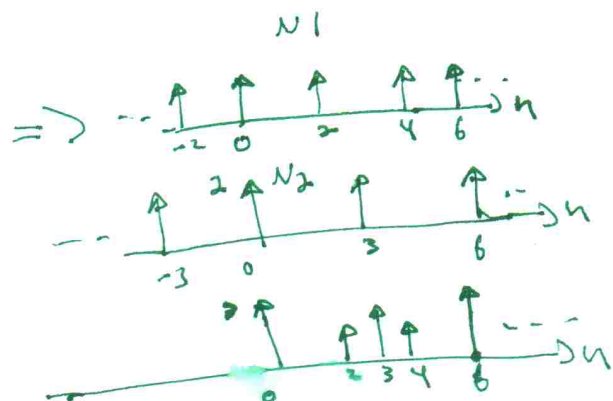
i. $x(t) = \exp(j \frac{7\pi}{6} t) + \exp(\frac{5}{6} t)$

ii. $x(n) = \sum_{m=-\infty}^{\infty} [\delta(n-2m) + 2\delta(n-3m)]$

i) $T_1 = 7/6$, T_2 is not periodic (because $e^{5/6 t}$ is not periodic)

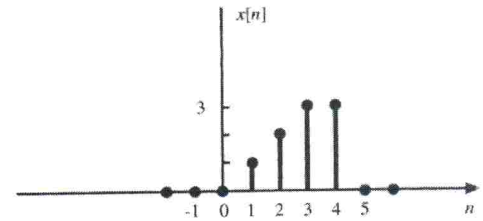
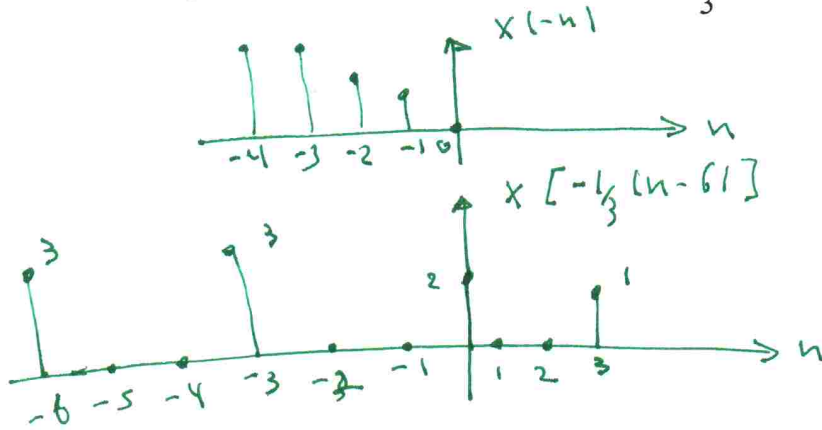
ii) $N_1 = 2$, $N_2 = 3$

$\therefore N = 6$



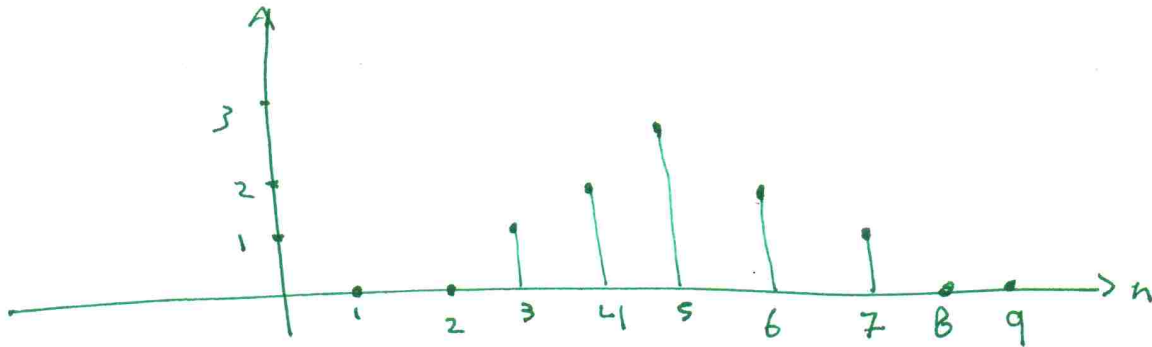
2. a- For the signal shown in the Fig. below, sketch $x[-\frac{n}{3}+2]$

(2 Points)



b- Sketch the following signal, $(n-2) \{ u[n-2] - u[n-6] \} + (-n+8) \{ u[n-6] - u[n-9] \}$

(2 Points)



c. Assume that the two systems are connected in cascade as shown in Fig. 3. Find the equivalent impulse response function, $h_s(t)$. (6 PT.)

$$h_1[n] = \delta[n+2] - \delta[n-2]$$

$$h_2[n] = n(u[n+4] - u[n-4]).$$

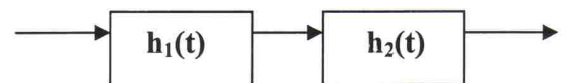
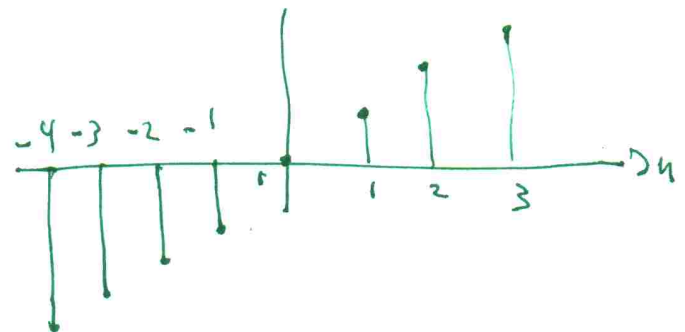
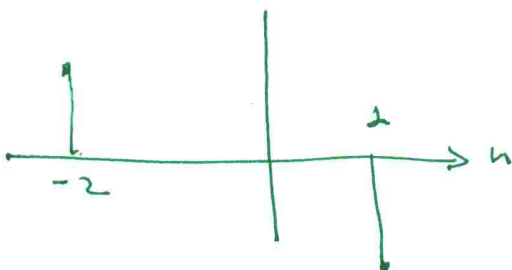
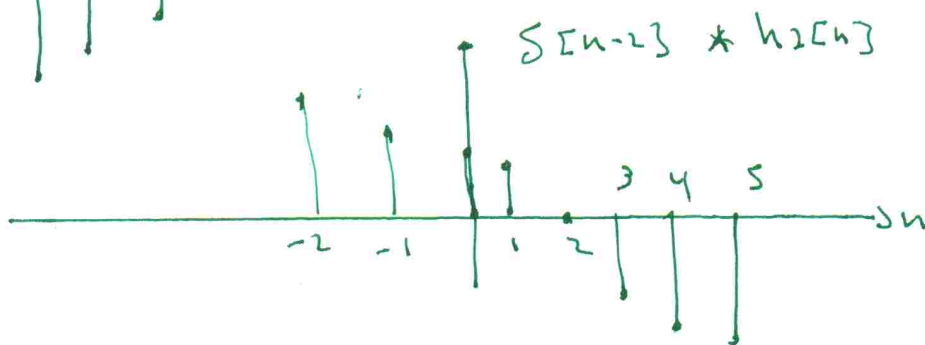
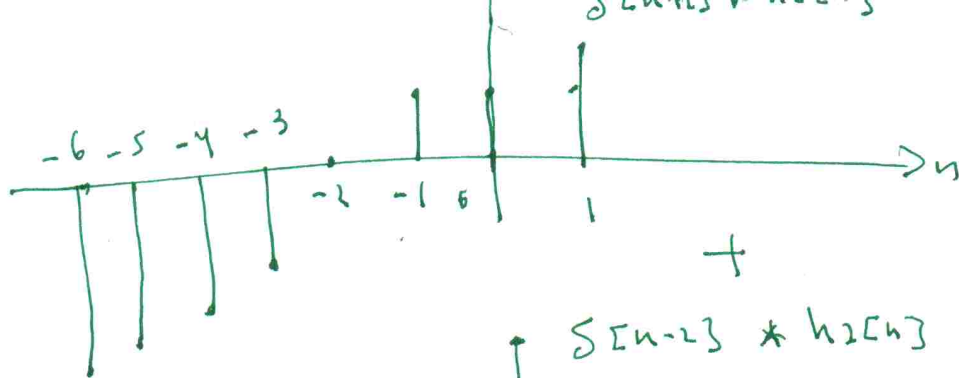


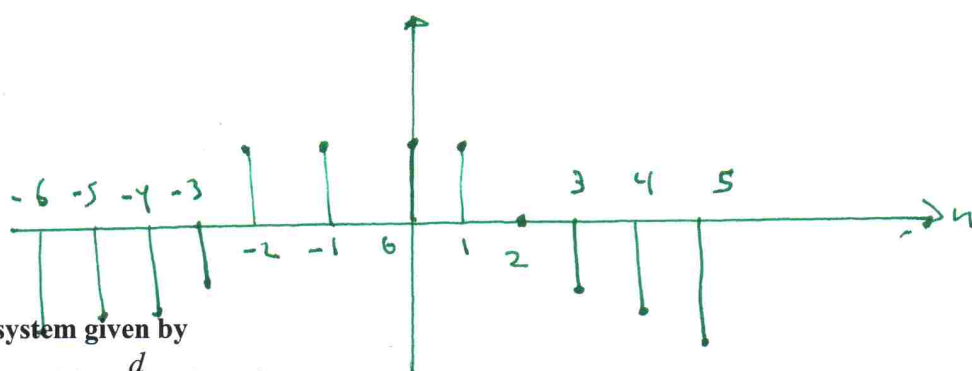
Fig. 3

$$h_s[n] = h_1[n] * h_2[n]$$





$h_1[n] * h_2[n]$



3. a) A system given by

$$y(t) = \frac{d}{dt} x(t-1)$$

Determine whether the system shown above is linear or nonlinear, causal or noncausal, time variant, or invariant, memory, or memoryless. (Justify your answer) (4 Pt.)

$$i) y_1(t) = \frac{d}{dt} x_1(t-1)$$

$$y_2(t) = \frac{d}{dt} x_2(t-1)$$

$$ay_1 + by_2 = a \frac{d}{dt} x_1(t-1) + b \frac{d}{dt} x_2(t-1) = \frac{d}{dt} [ax_1(t-1) + bx_2(t-1)]$$

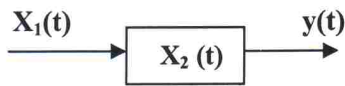
$\therefore$ system is linear

ii) system is not memoryless [system depends on past value]

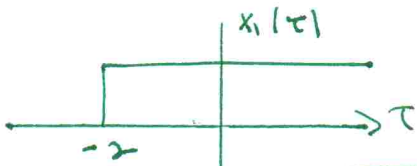
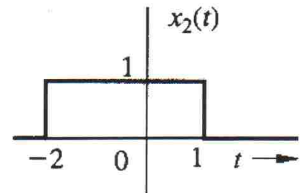
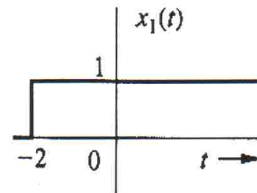
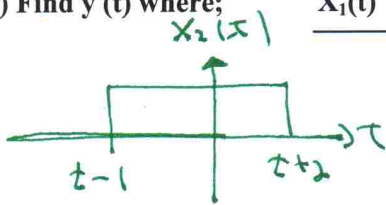
iii) system is causal [system does not depend on future]

iv) system is Time-invariant.

b) Find $y(t)$ where;



(6 Points)

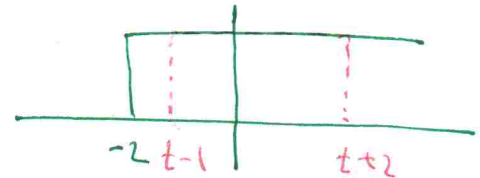
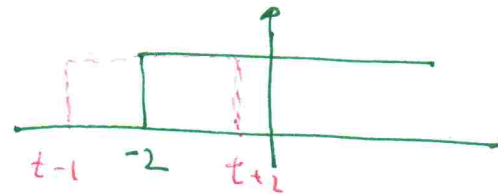


$$y(t) = 0 \quad t \leq -4$$

$$y(t) = \int_{-2}^{t+2} d\tau = t+4$$

$$-4 \leq t \leq -1$$

$$y(t) = \int_{t-1}^{t+2} d\tau = 3 \quad t \geq -1$$



$$\therefore y(t) = \begin{cases} 0 & t \leq -4 \\ t+4 & -4 \leq t < -1 \\ 3 & -1 \leq t \end{cases}$$

OR

$$y(t) = x_1(t) * x_2(t)$$

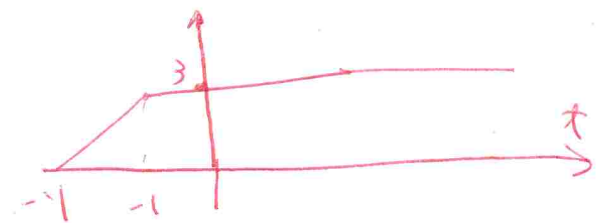
$$x_1(t) = u(t+2)$$

$$x_2(t) = u(t+2) - u(t-1)$$

$$y(t) = \int_{-\infty}^{\infty} u(t-\tau+2) u(\tau+2) d\tau - \int_{-\infty}^{\infty} u(t-\tau+2) u(\tau-1) d\tau$$

$$\therefore y_1 = \int_{-2}^{t+2} d\tau = t+4 \quad t \geq -4$$

$$y_2 = \int_{t-1}^{t+2} d\tau = t+1 \quad t \geq -1$$



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$$\therefore y(t) = y_1(t) - y_2(t) = (t+4) - (t+1) = 3$$

$$t \geq -1$$

$$y(t) = t+4$$

$$-4 \leq t \leq -1$$