

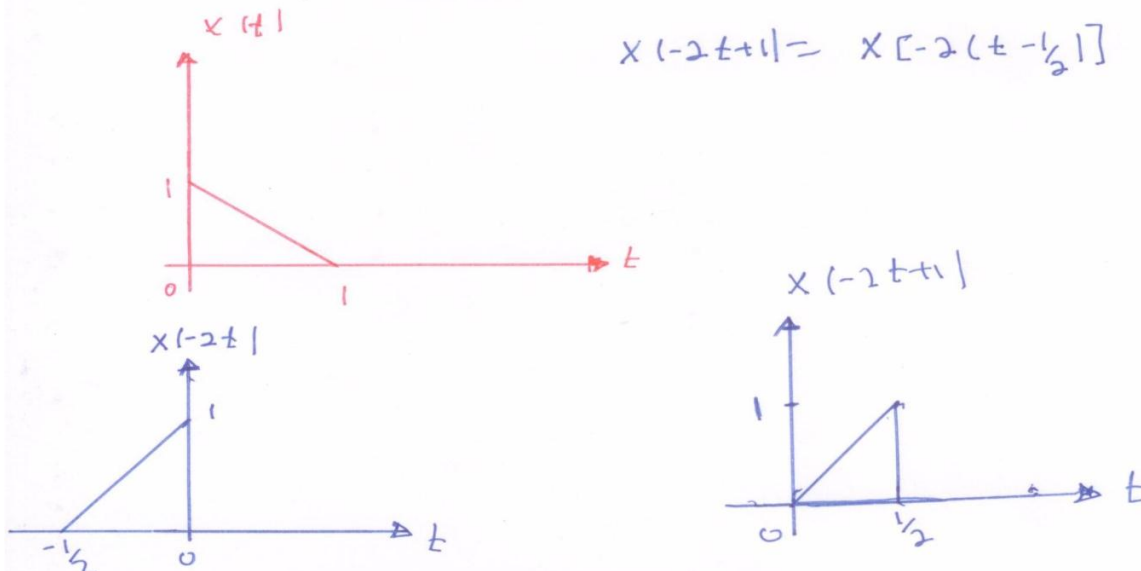
Islamic University of Gaza
Electrical Engineering Department
EELE 3310 Signals & Systems
Med-Term Exam
November 9, 2013



Dr. Basil Hamed
Name:

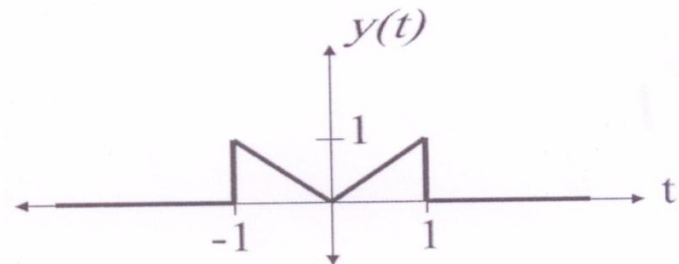
Exam Time 2:00-3:15
ID #

- a) Given $x(t) = \begin{cases} 1-t, & 0 \leq t \leq 1 \\ 0, & \text{otherwise} \end{cases}$, now sketch $x(-2t+1)$ (4 PT)



- b) Express the signal shown in the Fig by single expression (5 PT)

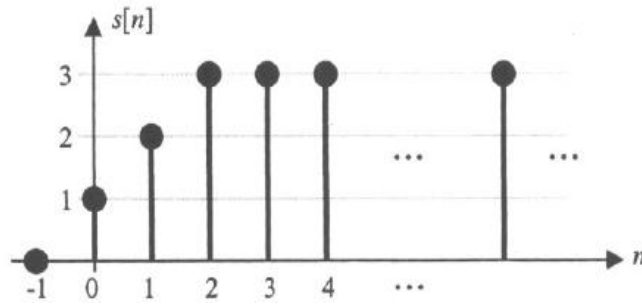
$$y(t) = -t u(t+1) + 2t u(t) - t u(t-1)$$



OR

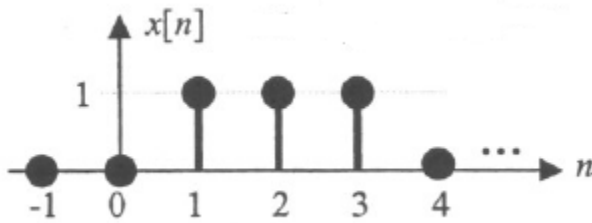
$$y(t) = r(-t) - r(-t-1) - u(-t-1) + r(t) - r(t-1) - u(t-1)$$

2. a) If the step response of discrete -time LTI system is $s[n]$ as shown in figure below,



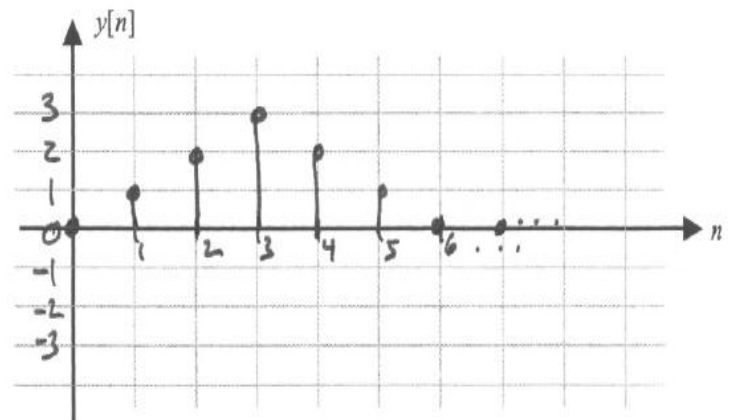
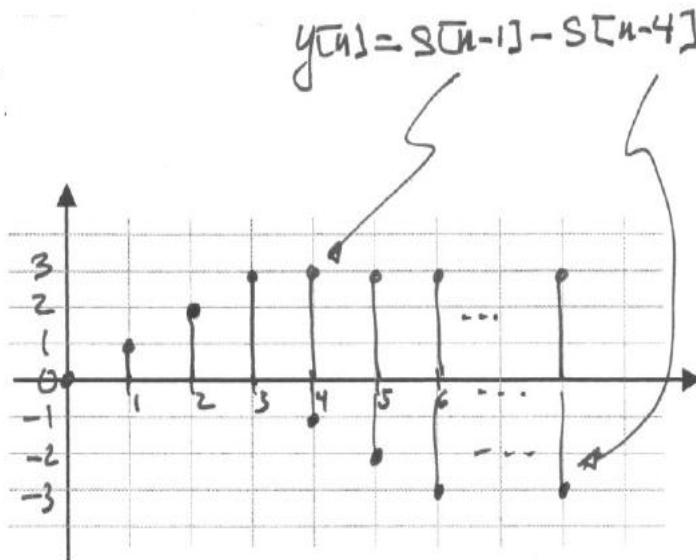
Sketch the system response to input $x[n]$ as shown in figure below.

(5 Pt.)



Solution

$$x[n] = u[n-1] - u[n-4] \quad \text{then} \quad y[n] = s[n-1] - s[n-4]$$



2. b) A discrete time system H has input $x[n]$ and output $y[n]$ related by $y[n] = n x[n+1] + 1$ (5 PT)

- Is the system H memoryless? Justify your answer
- Is the system H causal? Justify your answer
- Is the system H linear? Justify your answer
- Is the system H time invariant? Justify your answer
- Is the system H BIBO stable? Justify your answer

i) system is with memory because it is not ~~Instantaneous~~ Instantaneous $y[n] = x[n+1]$
It is not the same

ii) System is not causal ^{output} depend on the future of the input $y[n] = x[n+1]$

iii) Let $y_1[n] = H\{x_1[n]\} = n x_1[n+1] + 1$
 $y_2[n] = H\{x_2[n]\} = n x_2[n+1] + 1$

then $a y_1[n] + b y_2[n] = n a x_1[n+1] + n b x_2[n+1] + 1 + 1$

$$\underbrace{a y_1[n] + b y_2[n]}_{y[n]} = n \underbrace{\{a x_1[n+1] + b x_2[n+1]\}}_{x[n+1]} + \underbrace{(2)}_{\leftarrow}$$

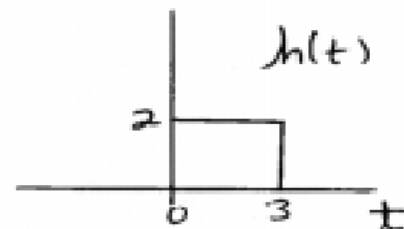
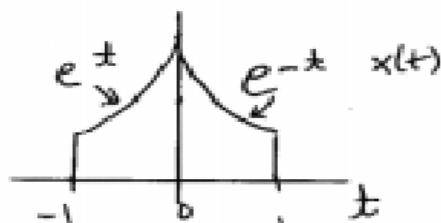
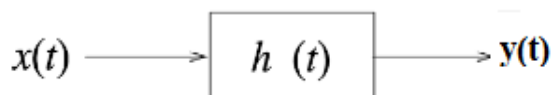
super position does not hold $\therefore$ System is not Linear

iv) System is Time Varying because there is multipl. of n ; $y[n] = \textcircled{n} x[n+1] + 1$

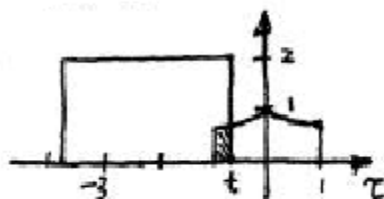
v) BTB does not apply here $\therefore$ System is not stable.

3) Determine $y(t)$ where $x(t)$ and $h(t)$ is as shown in the figure

(10 Pt)

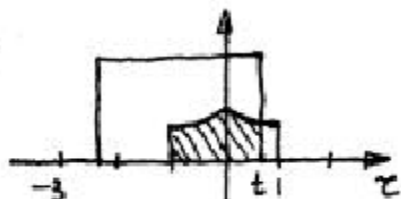


$$-1 \leq t < 0,$$



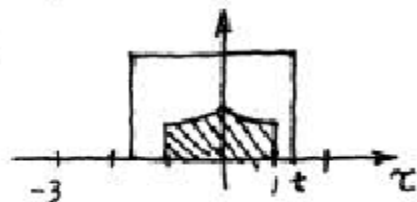
$$\begin{aligned} y(t) &= 2 \int_{-1}^t e^{\tau} d\tau = 2e^{\tau} \Big|_{-1}^t \\ &= 2e^t - 2e^{-1} \\ &= 2(e^t - e^{-1}) \end{aligned}$$

$$0 \leq t < 1,$$



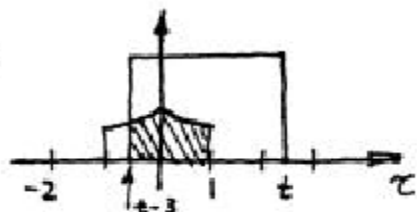
$$\begin{aligned} y(t) &= 2 \int_{-1}^0 e^{\tau} d\tau + 2 \int_0^t e^{-\tau} d\tau \\ &= 2e^{\tau} \Big|_{-1}^0 + (-2)e^{-\tau} \Big|_0^t \\ &= 2 - 2e^{-1} - 2e^{-t} + 2 \\ &= 4 - 2e^{-1} - 2e^{-t} \end{aligned}$$

$$1 \leq t < 2,$$



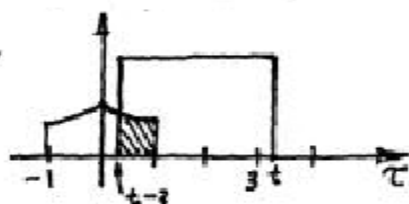
$$\begin{aligned} y(t) &= 2 \int_{-1}^0 e^{\tau} d\tau + 2 \int_0^1 e^{-\tau} d\tau \\ &= 2(1 - e^{-1}) + 2(1 - e^{-1}) \\ &= 4(1 - e^{-1}) \end{aligned}$$

$$2 \leq t < 3,$$



$$\begin{aligned} y(t) &= 2 \int_{t-3}^0 e^{\tau} d\tau + 2 \int_0^1 e^{-\tau} d\tau \\ &= 2(1 - e^{t-3}) + 2(1 - e^{-1}) \\ &= 4 - 2e^{-1} - 2e^{t-3} \end{aligned}$$

$$3 \leq t < 4,$$



$$\begin{aligned} y(t) &= 2 \int_{t-3}^1 e^{-\tau} d\tau = -2e^{-\tau} \Big|_{t-3}^1 \\ &= 2e^{-t+3} - 2e^{-1} \\ &= 2(e^{3-t} - e^{-1}) \end{aligned}$$

elsewhere, $y(t) = 0$

$$y(t) = \begin{cases} 2(e^t - e^{-1}) & -1 \leq t < 0 \\ 4 - 2e^{-1} - 2e^{-t} & 0 \leq t < 1 \\ 4(1 - e^{-1}) & 1 \leq t < 2 \\ 4 - 2e^{-1} - 2e^{t-3} & 2 \leq t < 3 \\ 2(e^{3-t} - e^{-1}) & 3 \leq t < 4 \\ 0 & \text{otherwise} \end{cases}$$