In the Name of Allah

Assignment 1

Deadline : 1400 / 12 / 15

Email : signalspring2022@gmail.com

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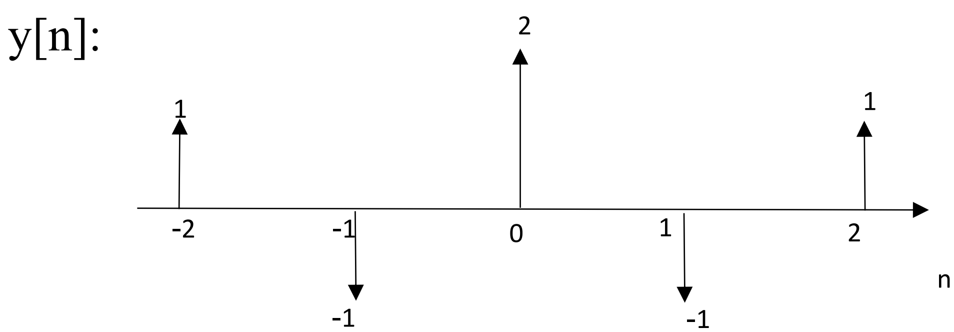
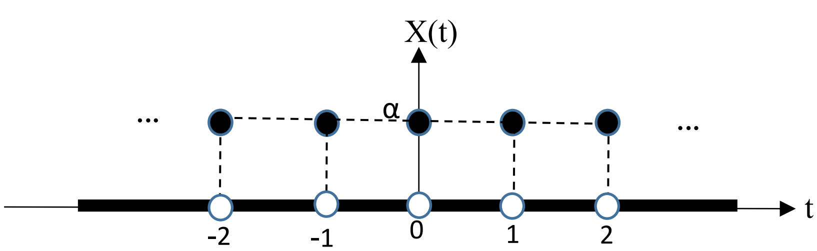
1. Sketch x[n] in case y[n] is the even part of signal x[n] and we know that for n<0 ; x[n]=0.



2. Compute the energy of the following signals:

a) x[n] $= \sum_{k=-\infty}^{\infty}(-1)^k\delta[n-k]$

b)



3. For each of the following LTI systems determine whether the corresponding system is (i) Stable (ii) Casual.

(a) $h_1(t) = \delta(t) + e^{-5t}u(t)$
(b) $h_2(t) = e^{-5t}\sin(2\pi t)u(t)$
(c) $h_3(t) = e^{-2|t|} + u(t+1) - u(t-1)$
(d) $h_4(t) = t[u(t+4) - u(t-4)]$
(e) $h_5(t) = \sin(10t)$
(f) $h_6(t) = \cos(5t)u(t)$
(g) $h_7(t) = 0.95^{|t|}$
(h) $h_8(t) = \begin{cases} 1, -1 \le t < 0 \\ -1,\ 0 \le t \le 1 \\ 0,\ \text{otherwise} \end{cases}$

4. Determine whether or not each of the following signals is periodic. If the signal is periodic, find its fundamental period.

a. $x(t) = e^{j\left(2t+\frac{\pi}{3}\right)}$
b. $x(t) = [\sin(5t-1)]^2$
c. $x[n] = (-1)^n \cos\left(\frac{2\pi}{7}n\right)$

5. Determine whether each of the signals is a power signal or an energy signal. Next, calculate their energy (E_x) or power (P_x) based on their type.

a. $x(t) = e^{-2t}u(t)$
b. $x(t) = \sin(5\pi t)$
c. $x[n] = \begin{cases} 1; & n \ge 0 \\ 0; & 0.w \end{cases} = u[n]$
d. $x(t) = \begin{cases} \frac{1}{\sqrt{t}}; & t \ge 0 \\ 0; & 0.w \end{cases}$

6. Consider a system S with input $x[n]$ and output $y[n]$. This system is obtained through a series interconnection of a system S_1 followed by a system S_2. The input-output relationships for S_1 and S_2 are

$$S_1: \quad y_1[n] = 2x_1[n] + 4x_1[n-1]$$
$$S_2: \quad y_2[n] = x_2[n-2] + \frac{1}{2}x_2[n-3]$$

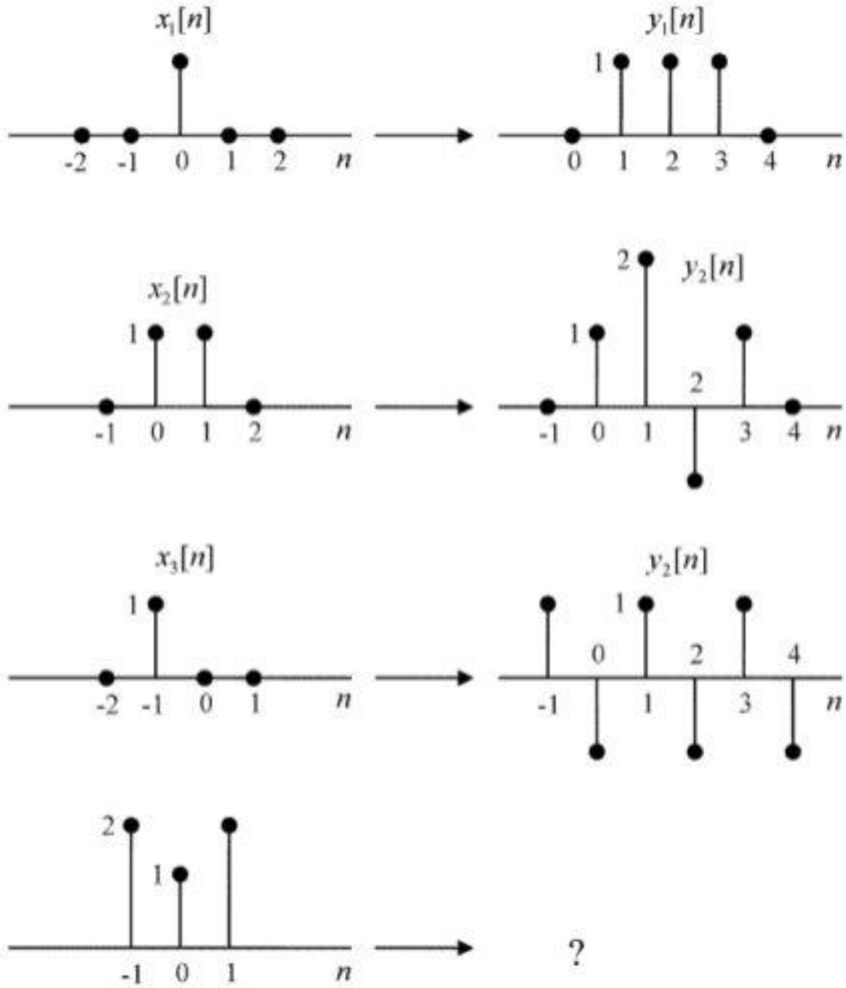
where $x_1[n]$ and $x_2[n]$ denote input signals.
(a) Determine the input-output relationship for system S.
(b) Does the input-output relationship of system S change if the order in which S_1 and S_2 are connected in series is reversed (i.e., if S_2 follows S_1)?

7. Is inverse of a casual and stable system necessarily casual and stable ? Justify your answer

8. Is product of two continuous periodic signals necessarily periodic ? How about discreate signals ? Justify your answer.

9. In order to identify a linear discreate time signals (probably time variant), the following three experiments are carried out (Three inputs are passed to the system and the output is observed). Determine whether or not the system is time invariant?

If the input to the system is x[n] (shown), sketch the output.


$x_1[n]$
-2 -1 0 1 2 n
$y_1[n]$
1
0 1 2 3 4 n
$x_2[n]$
1
-1 0 1 2 n
2 $y_2[n]$
1
2
-1 0 1 3 4 n
$x_3[n]$
1
-2 -1 0 1 n
$y_2[n]$
1
0 2 4
-1 1 3 n
2
1
-1 0 1 n
?

Good Luck