1.2.1 A discrete-time system may be classified as follows:

- memoryless/with memory
- causal/noncausal
- linear/nonlinear
- time-invariant/time-varying
- BIBO stable/unstable

Classify each of the following discrete-times systems.

(a) $y(n) = \cos(x(n))$.

Memoryless , causal, nonlinear, time-invariant, BIBO stable

(b) $y(n) = 2n\ 2\ x(n) + nx(n + 1)$.

with memory, noncausal, nonlinear, time-invariant, unstable

(c) $y(n) = \max\{x(n), x(n + 1)\}$

Note: the notation max{a, b} means for example; max{4, 6} = 6.

with memory, noncausal, nonlinear, time-invariant, BIBO stable

(d) $y(n) = x(n)$ when n is even

$= x(n - 1)$ when n is odd

with memory, causal, nonlinear, time-varying, BIBO stable

1.2.2 A discrete-time system is described by the following rule

$$y(n) = 0.5x(2n) + 0.5x(2n - 1)$$

where x is the input signal, and y the output signal.

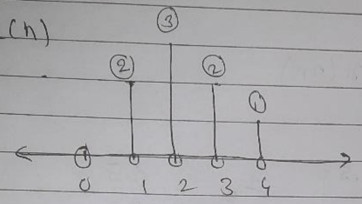
(a) Sketch the output signal, $y(n)$, produced by the 4-point input signal, $x(n)$ illustrated below.

(1.2.2.A)

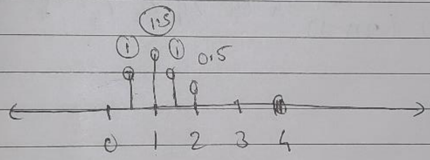
$$y(n) = (0.5)\cdot x(2n) + (0.5)\cdot x(2n-1)$$

(b)

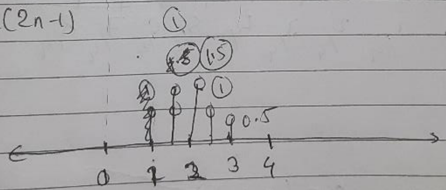
$x(n)$



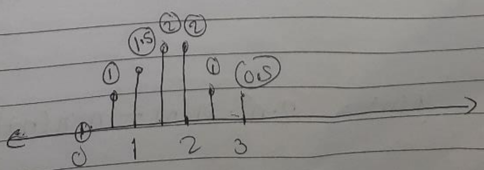

$(0.5).\, x(2n)$




$(0.5)\cdot x(2n-1)$

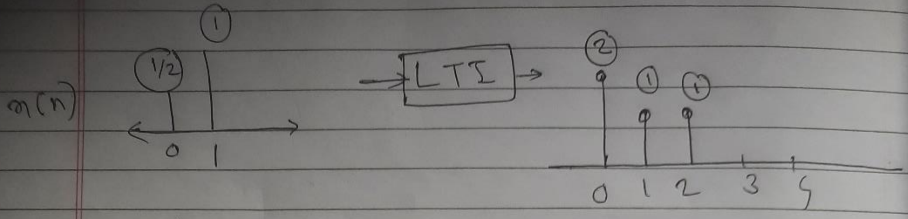



$y(n)$



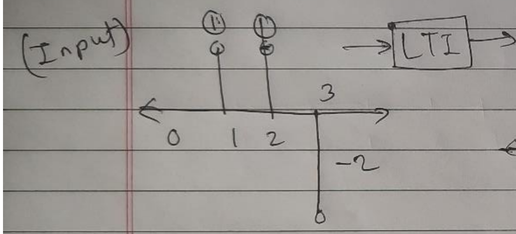

$y(n) = 0, 1, 1.5, 2, 2, 1, 0.5$

1.2.Q

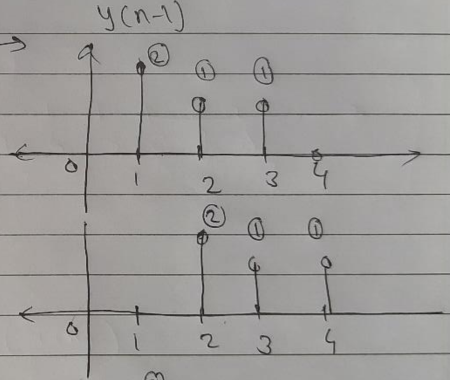


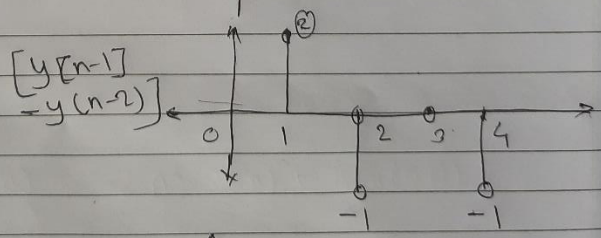

$2[x(n-1) - x(n-2)]$

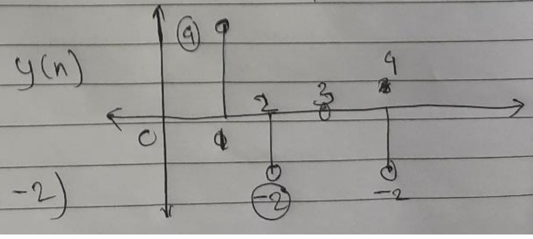
$2[y(n-1) - y(n-2)]$




y(n-1)



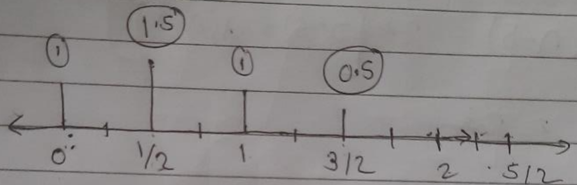



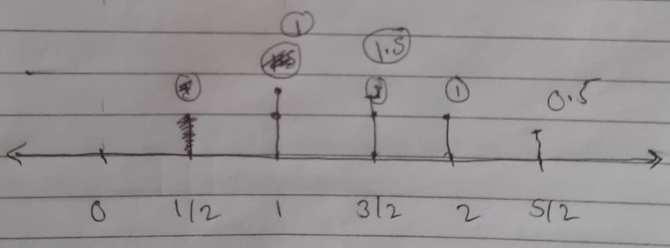

y(n) = (0, 4, -2, 0, -2)

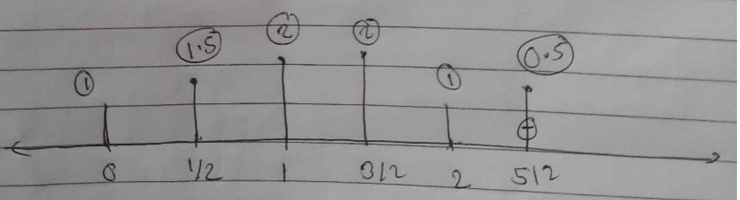
(1.2.2) A

(a) $(0.5) \cdot x(2n)$




$0.5 : x(2n-1)$




$y[n] = [1, 1.5, 2, 2, 1, 0.5]$

(b) Sketch the output signal, $y(n)$, produced by the 4-point input signal, $x(n)$ illustrated below.

(c) System Classification:

i. causal

ii. linear

iii. time-varying