1) The impulse response of a discrete-time LTI system is given by

{ h(n) = 0.25 for $0 \le n \le 30$

h(n) = 0 for other values of n. }

Make an accurate sketch of the output of the system when the input signal is

{x(n) = 1 for $0 \le n \le 30$

x(n) = 0 for other values of n. }

2) Impulse response h[n] of discrete time LTI

system. h[n] = 0 , $n<0$

1 , $0 \le n \le 4$

-1 , $4<n \le 6$

0 , $n>6$

x[n] = 0 , $n<2$

1 , n=2

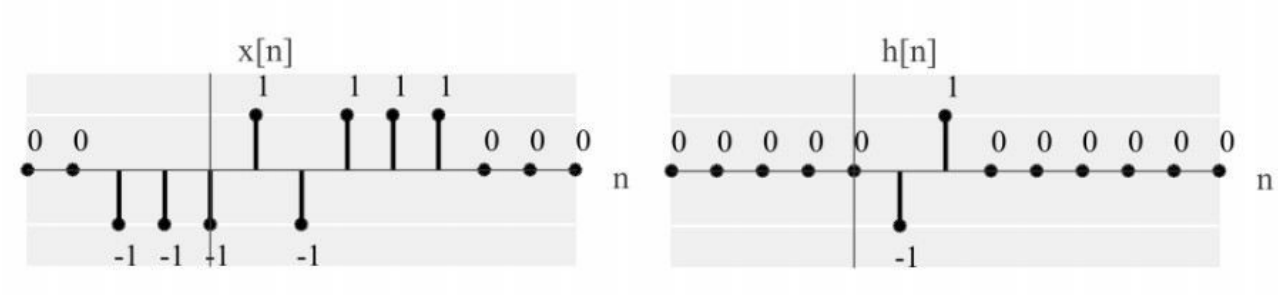
0 , n=3

-1 , n=4

0 , n>4

Skecth the output y[n].

3) Consider the following discrete-time signal x[n] and an LTI system with impulse response h[n]. Assume the zeros continue forever for $n \to -\infty$ and $n \to \infty$.

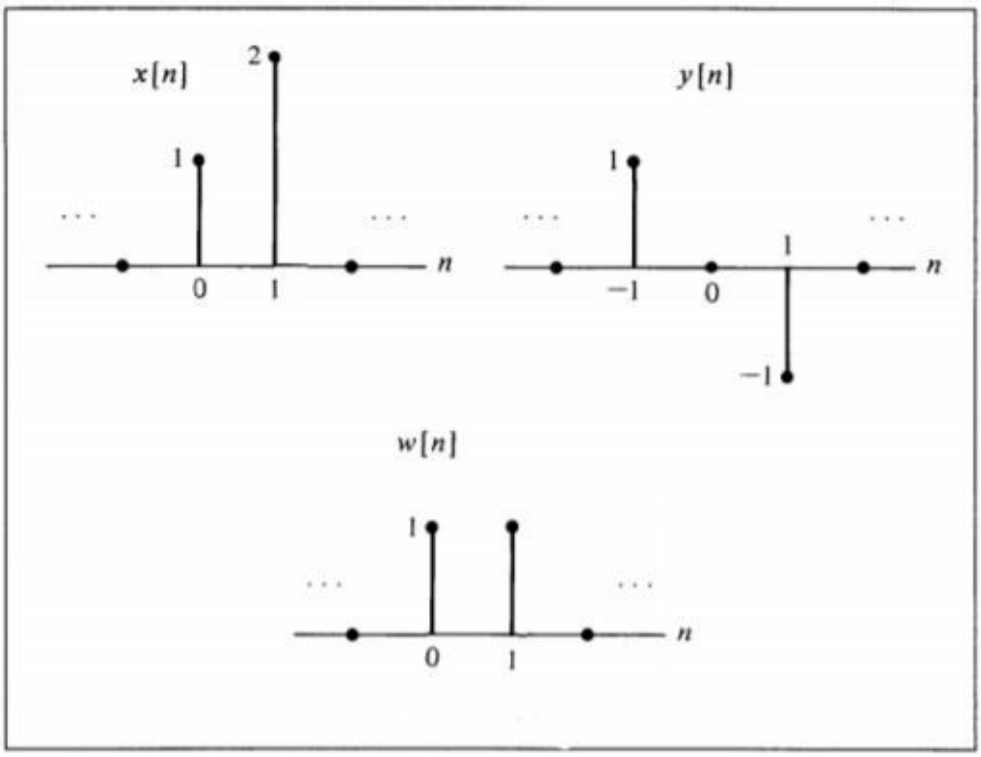


a)Sketch the system output $y[n] = x[n] * h[n]$.

b)Sketch y[n] = h[n] ∗ h[−n].
c)Is the system with impulse response h[n] causal?

4)

Consider the three discrete-time signals shown in Figure



(a) Verify the distributive law of convolution:

$$(x + w) * y = (x * y) + (w * y)$$

(b) You may have noticed a similarity between the convolution operation and multiplication, but they are *not* equivalent. Verify that

$$(x * y) \cdot w \neq x * (y \cdot w)$$

5) A linear system S has the relationship y[n] =Σ_Kx[k]*g[n – 2k], k ranging from -∞ to ∞, between its input x[n] and its output y[n], where g[n] = u[n] - u[n- 4]

(a) Determine y[n] when x[n] = δ[n- 1].
(b) Determine y[n] when x[n] = δ[n- 2].
(c) Is S LTI?

6) Find x(n) ∗ δ(n - n0) = x(n - n_0). What do you observe?

7) Define FIR and IIR systems. Given that h[n] is the impulse response of an LTI IIR system, does there exist an input x[n] for which the output y[n]=x[n]∗h[n] is non zero for finite values?

8) An LTI system with input x[n] and output y[n] has impulse response h[n] = δ[n] + 2δ[n − 1] +3δ[n − 2]. Find the system's output y[n] when x[n]=−2+3cos((π/4)n+π/3)+10cos((3π/4)n − π/5).

9) An LTI system with input x[n] and output y[n] has impulse response h[n] = δ[n]

+ 2δ[n − 1] +3δ[n − 2]. Find the system's

[a] Frequency response H(e^jω), and

[b] Steady-state output y[n] when
x[n]=−2+3cos((π/4)n+π/3)+10cos((3π/4)n − π/5).

10)A system has causal finite impulse response,
h[n]=1 for n=0,1;
-1 for n=2,3;
a) Find $H(e^{j\omega})$
b)Find the output when input x[n]=2δ[n]-δ[n-2]+3δ[n-3]

11) Given an LTI system,
h[n] = a^n , 0≤n
0 , n>0
|a|<1
and x[n]=u[n]-u[n-N]
find y[n], $H(e^{j\omega})$ and Y(jω) and determine whether the system is causal or not.

12) Define what is an eigenfunction of an LTI system. Derive the eigen value λ corresponding to the input e^{sn}, given that the impulse response is h[n].