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(Question 2)

1.

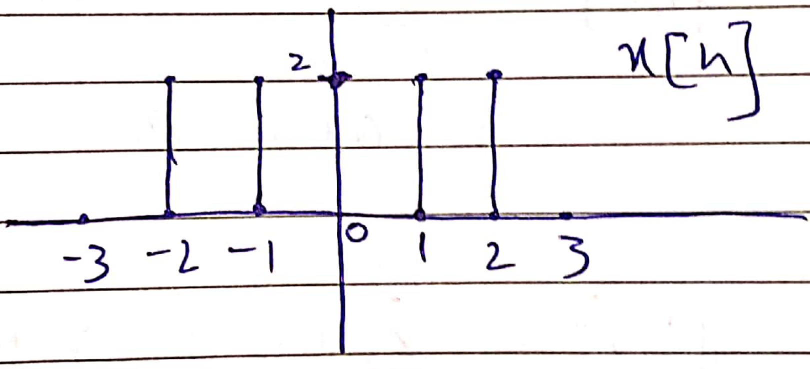
$$x[n] = \begin{cases} 2 & -2 \le n \le 2 \\ 0 & \text{otherwise} \end{cases}$$

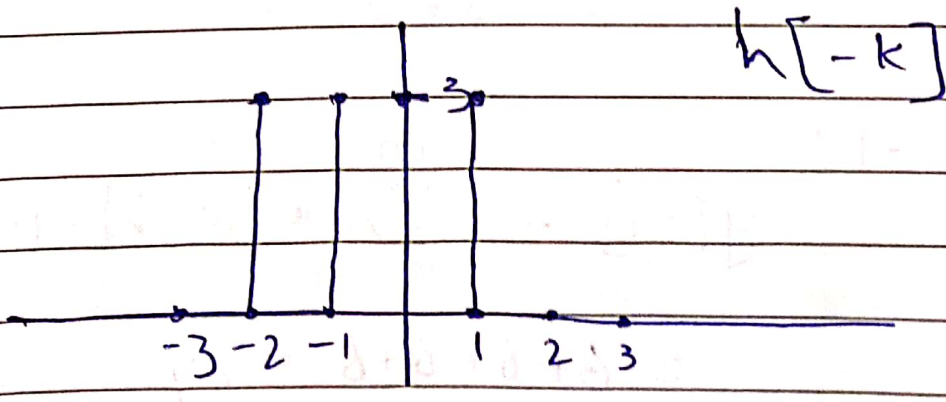
$$h[n] = \begin{cases} 3 & -1 \le n \le 2 \\ 0 & \text{otherwise} \end{cases}$$

Solution:

As we know that

$$y[n] = \sum_{k=-\infty}^{\infty} x[k]h[n-k]$$





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For $n=0$:

$$y(0) = \sum_{k=-\infty}^{\infty} x[k]h[-k]$$

$$= 6+6+12 = 24$$

For $n=1$:

$$y[1] = \sum_{k=-\infty}^{\infty} x[k]h[1-k]$$

$$= 6+6+6 = 18$$

For $n=2$:

$$y[2] = \sum_{k=-\infty}^{\infty} x[k]h[2-k]$$

$$= 6+6 = 12$$

For $n=3$:

$$y[3] = \sum_{k=-\infty}^{\infty} x[k]h[3-k]$$

$$= 6+0 = 6$$

For $n=-1$:

$$y[-1] = \sum_{k=-\infty}^{\infty} x[k]h[-1-k]$$

$$= 6+6+6+6 = 24$$

For $n=-2$:

$$y[-2] = \sum_{k=-\infty}^{\infty} x[k]h[-2-k]$$

$$= 6+6+6 = 18$$

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For $n = -3$:

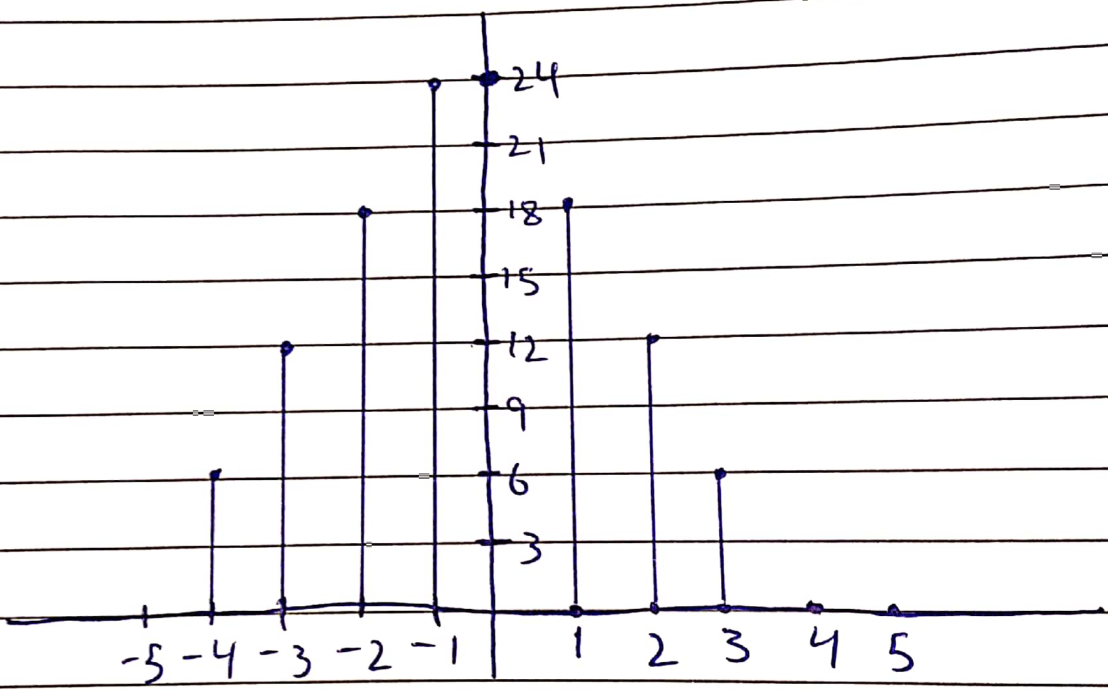
$$y[-3] = \sum_{k=-\infty}^{\infty} x[k]\,h[-3-k]$$

$$= 6 + 6 = 12$$

For $n = -4$:

$$y[-4] = \sum_{k=-\infty}^{\infty} x[k]\,h[-4-k]$$

$$= 6 + 0 = 6$$



(a) It is non causal as it depends upon future inputs

(b) It is stable because sum of outputs is finite.

(2)

Homogeneous equation:

A first order differential equation

$$dy\,dx = f(x,y)$$

is called homogeneous equation in which we put one side of the equation equal to zero.

Particular solution:

Particular solution of equation means solution at some fixed value.

$$y[n] = \frac{5}{6}y(n-1) - \frac{1}{6}y[n-2] + x(n]$$

$$x[n] = 2^n U[n]$$

To find particular solution

$$y_p(n) = K2^n U[n]$$

$$\frac{5}{6}K2^{n-1}U(n-1) - \frac{1}{6}K.2^{n-2}U(n-2) + 2^n U[n]$$

use $n=2$

$$\frac{5}{6}K2^{2-1}U(2-1) - \frac{1}{6}K2^{2-2}U(2-2) + 2^2 U(2)$$

$$\frac{5}{6}K\,2U(1) - \frac{1}{6}K2^0 U(0) + 4(1)$$

$$\frac{5}{3}K - \frac{1}{6}K + 4$$

$$= \frac{10K - 1 + 24}{6} = 0$$

$$= 10K + 23 = 0$$

$y_p[n]$: $K = -23/10$

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(3)

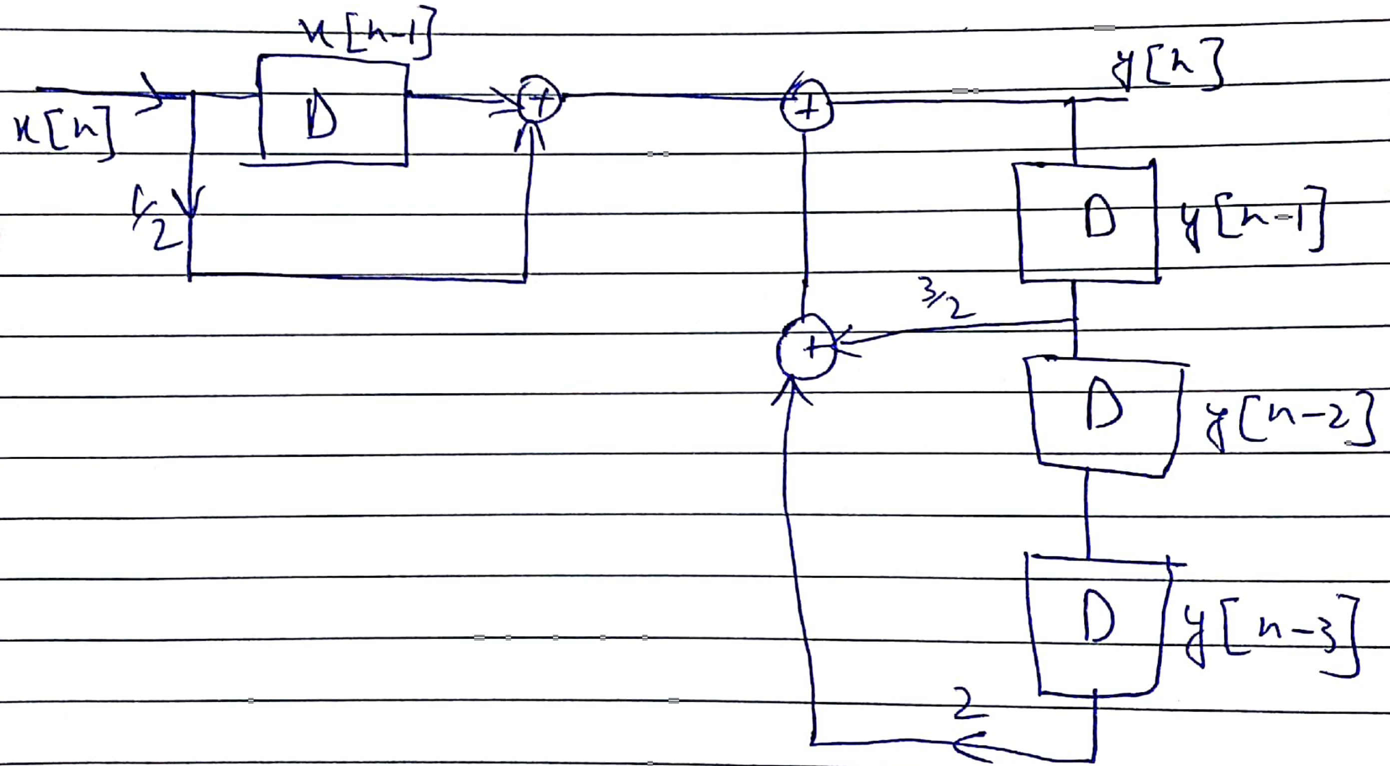
$$2y[n] - 3y[n-1] - 4y[n-3] = x[n] + 2x[n-1]$$

$$2y[n] = x[n] + 2x[n-1] + 3y[n-1] + 4y[n-3]$$

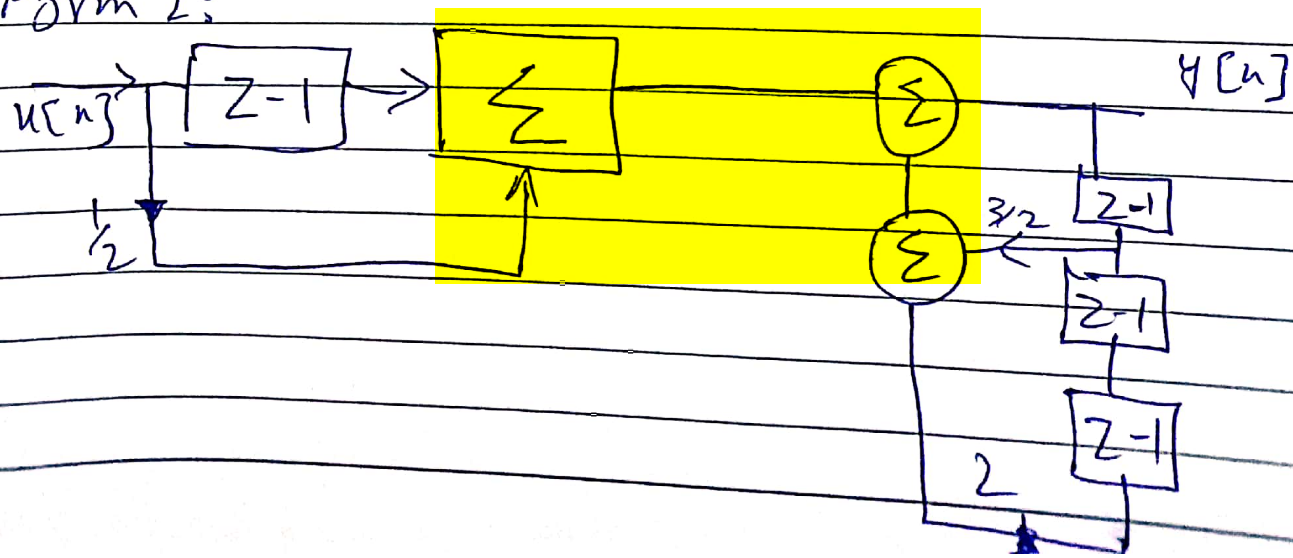
$$y[n] = \frac{x[n] + 2x[n-1] + 3y[n-1] + 4y[n-3]}{2}$$

$$y[n] = \frac{1}{2}x[n] + x[n-1] + \frac{3}{2}y[n-1] + 2y[n-3]$$

Form 1:



Form 2:



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The direct form 2 is better implementatio than form 1 because in that the memory delays z^{-1} ules lessor half while in direct form 1 the memory delays use double.