Convolution:-

⊛ Mathematical Method :-

Exp:- $h[n] = \{\underset{\uparrow}{2}, 1\}$

$x[n] = \{\underset{\uparrow}{3}, 4, 5\}$

Sol:-

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

$L = 2 + 3 - 1 = \boxed{4}$

$n = 0,$

$$y[0] = \sum_{k=0}^{0} x[k]\, h[-k]$$

$$= x[0]\, h[0]$$

$$= (3)(2)$$

$$= \boxed{6}$$

n=1,

$$y[1] = \sum_{k=0}^{1} x[k]\,h[1-k]$$

$$= x[0]h[1] + x[1]h[0]$$

$$= 3(1) + 4(2)$$

$$= 3 + 8 = \boxed{11}$$

n=2,

$$y[2] = \sum_{k=0}^{2} x[k]\,h[2-k]$$

$$= x[0]\,h[2] + x[1]h[1] +$$

$$x[2]h[0]$$

$$= 3(0) + 4(1) + 5(2)$$

$$= \boxed{14}$$

$n=3,$

$$y[3] = \sum_{k=0}^{3} x[k]\,h[3-k]$$

$$= x[0]h[3] + x[1]h[2] + x[2]h[1] + x[3]h[0]$$

$$= 3(0) + 4(0) + 5(1) + 0(2)$$

$$= 0+0+5+0 = \boxed{5}$$

For $n \geq 0$ we get (h)

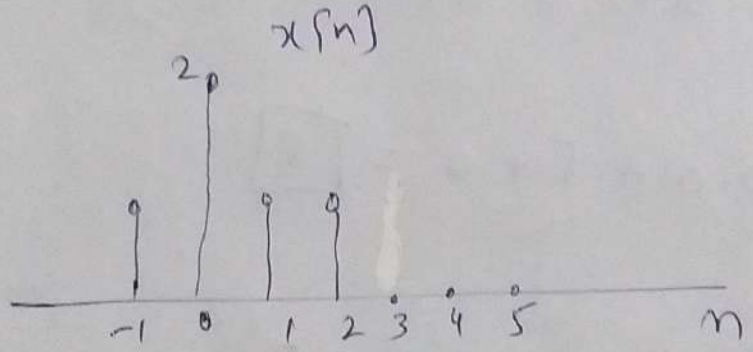
$$y[n] = \{6, 11, 14, 5\}$$

⑧ Sequence Method (Index Method):-

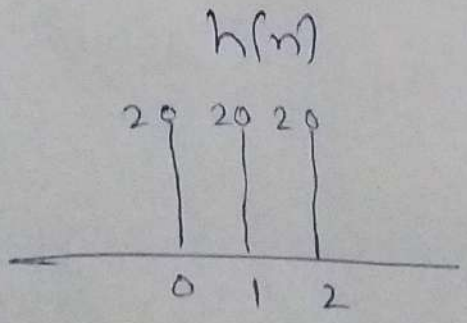
Exp:- $x[n] = 4[n+1] - 4[n-3] + \delta[n]$

$h[n] = 2\{4[n] - 4[n-3]\}$

$x[n] = \{1, \underset{\uparrow}{2}, 1, 1\}$



$h[n] = \{\underset{\uparrow}{2}, 2, 2\}$



Length $= 4 + 3 - 1$

$= \boxed{6}$

$n=0,$

$h[-k] = \{2, 2, \underset{\uparrow}{2}\}$ (Folding)

$V_0(k) = \{0, 2, 4, 0, 0\}$ (Product) $x[n]\,h[-k]$

$y[0] = 6$ (sum)

For $n=1$,

$h[1-k] = \{2, \underset{\uparrow}{2}, 2\}$

$V_1(k) = \{2, 4, 2\}$

$y[1] = 8$

For n=2,

$$h[2-k] = \{\underset{\uparrow}{2}, 2, 2\}$$

$$V_2(k) = \{4, 2, 2\}$$

$$y[2] = 8$$

For n=3,

$$h[3-k] = \{\underset{\uparrow}{0}, 2, 2, 2\}$$

$$V_3(k) = \{0, 2, 2\}$$

$$y[3] = 4$$

For $n=4$,

$$h[4-k] = \{\underset{\uparrow}{0}, 0, 2, 2, 2\}$$

$$V_4(k) = \{0, 0, 2\}$$

$$y[4] = 2$$

For $n=5$,

$$h[5-k] = \{\underset{\uparrow}{0}, 0, 0, 2, 2, 2\}$$

$$V_5(k) = \{0, 0, 0\}$$

$$y(5) = 0$$

So Need for this $\boxed{n=5}$.

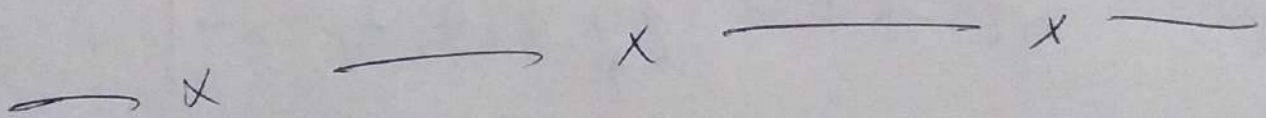
For $n=-1$

$$h[-1-k] = \{2, 2, 2, \underset{\uparrow}{0}\}$$

$$v_1(k) = \{0, 0, 2, 0\}$$

$$y[-1] = 2$$

$$y[n] = \{2, \underset{\uparrow}{6}, 8, 8, 4, 2\}$$



⑧ Correlation of DTS:-

The objective of correlation is to measure the degree to which the two sequences are similar & to extract useful information based on the similarity.

① Cross correlation (Different signals)

② Auto Correlation (Same signals)

Correlation is represented by "r"

① Cross - Correlation:-

$$r_{xy}[l] = \sum_{n=-\infty}^{\infty} x[n]\, y[n-l]$$

where, xy = Two signals

x = reference unshifted

y = shifted.

l = lag delay = $0, \pm 1, \pm 2, \cdots$

$$r_{xy}[l] = \sum_{n=-\infty}^{\infty} x[n]\, y[n-l]$$

$$\gamma_{xy}[l] = \sum_{n=-\infty}^{\infty} x[n+l]\, y[n]$$

— x — x —

Exple:-

$$\gamma_{xy}[l] = ?$$

$$x[n] = \{2, -1, 3, 7, \underset{\uparrow}{1}, 2, -3\}$$

$$y[n] = \{1, -1, 2, -2, \underset{\uparrow}{4}, 1, -2, 5\}$$

Home Assignment