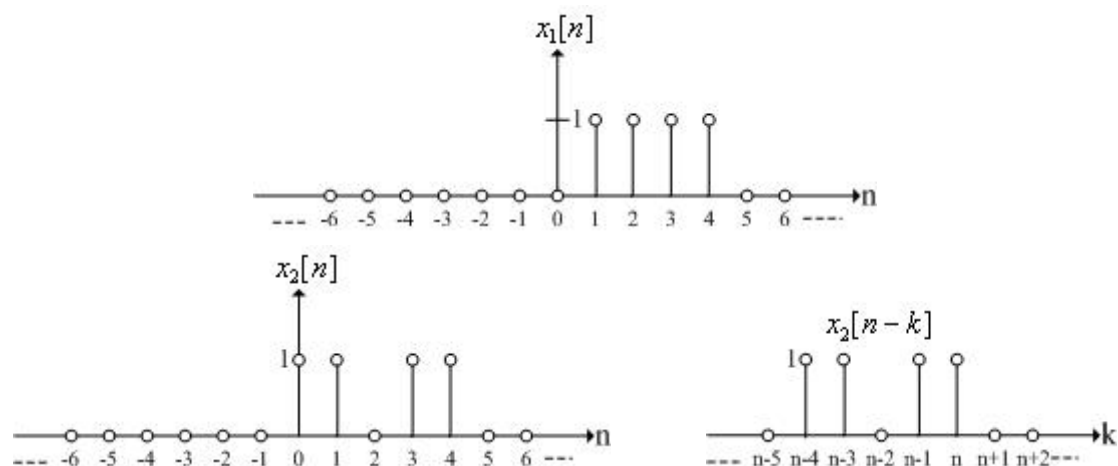


### Homework No. 7\_1 Solution

1.

(1) (15%)



$$y[n] = x_1[n] * x_2[n] = \sum_{k=-\infty}^{\infty} x_1[k]x_2[n-k]$$

$$\text{For } n=1 \Rightarrow y[1] = \sum_{k=-\infty}^{\infty} x_1[k]x_2[1-k] = 1$$

$$\text{For } n=2 \Rightarrow y[2] = \sum_{k=-\infty}^{\infty} x_1[k]x_2[2-k] = 2$$

$$\text{For } n=3 \Rightarrow y[3] = \sum_{k=-\infty}^{\infty} x_1[k]x_2[3-k] = 2$$

$$\text{For } n=4 \Rightarrow y[4] = \sum_{k=-\infty}^{\infty} x_1[k]x_2[4-k] = 3$$

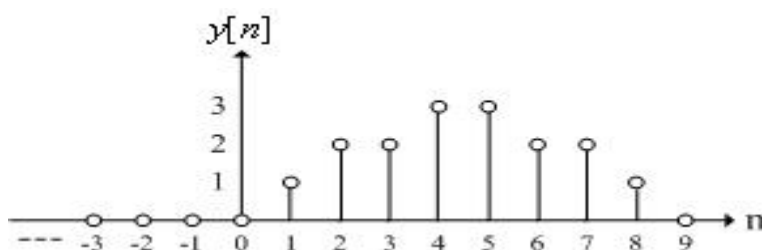
$$\text{For } n=5 \Rightarrow y[5] = \sum_{k=-\infty}^{\infty} x_1[k]x_2[5-k] = 3$$

$$\text{For } n=6 \Rightarrow y[6] = \sum_{k=-\infty}^{\infty} x_1[k]x_2[6-k] = 2$$

$$\text{For } n=7 \Rightarrow y[7] = \sum_{k=-\infty}^{\infty} x_1[k]x_2[7-k] = 2$$

$$\text{For } n=8 \Rightarrow y[8] = \sum_{k=-\infty}^{\infty} x_1[k]x_2[8-k] = 1$$

$$\text{For } n = O.W \Rightarrow y[n] = 0$$



(2) (25%)

The  $\tilde{y}[n]$  is a periodic sequence of period 5, so we only considered one period.

$$\tilde{y}[n] = \sum_{k=0}^4 \tilde{x}_2[k] \tilde{x}_1[n-k]$$

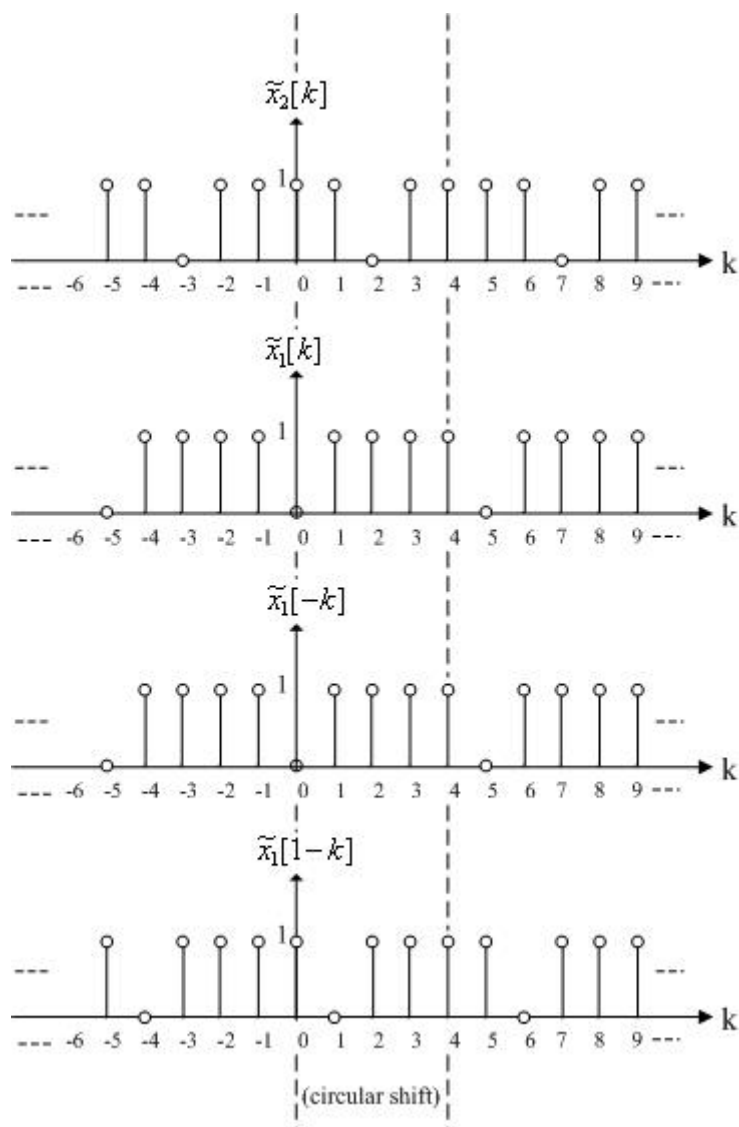
$$\text{For } n=0 \Rightarrow \tilde{y}[0] = \sum_{k=0}^4 \tilde{x}_2[k] \tilde{x}_1[-k] = 3$$

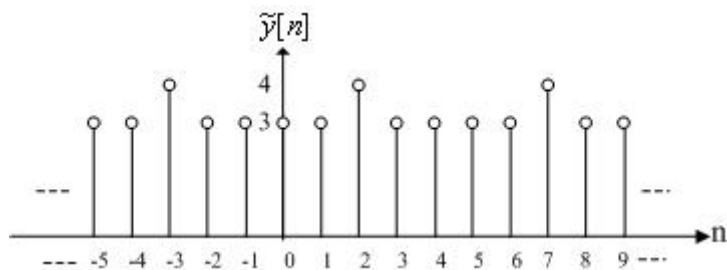
$$\text{For } n=1 \Rightarrow \tilde{y}[1] = \sum_{k=0}^4 \tilde{x}_2[k] \tilde{x}_1[1-k] = 3$$

$$\text{For } n=2 \Rightarrow \tilde{y}[2] = \sum_{k=0}^4 \tilde{x}_2[k] \tilde{x}_1[2-k] = 4$$

$$\text{For } n=3 \Rightarrow \tilde{y}[3] = \sum_{k=0}^4 \tilde{x}_2[k] \tilde{x}_1[3-k] = 3$$

$$\text{For } n=4 \Rightarrow \tilde{y}[4] = \sum_{k=0}^4 \tilde{x}_2[k] \tilde{x}_1[4-k] = 3$$





(3) (25%)

$$y[n] = \sum_{k=0}^4 x_2[k]x_1[((n-k))_5], 0 \leq n \leq 4$$

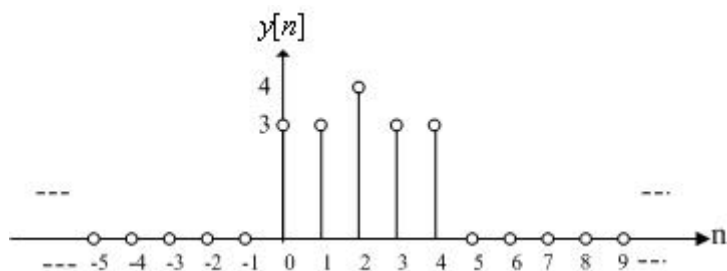
$$\text{For } n=0 \Rightarrow y[0] = \sum_{k=0}^4 x_2[k]x_1[(-k)_5] = \sum_{k=0}^4 x_2[k]x_1[(5-k)_5] = 3$$

$$\text{For } n=1 \Rightarrow y[1] = \sum_{k=0}^4 x_2[k]x_1[(1-k)_5] = \sum_{k=0}^4 x_2[k]x_1[(6-k)_5] = 3$$

$$\text{For } n=2 \Rightarrow y[2] = \sum_{k=0}^4 x_2[k]x_1[(2-k)_5] = \sum_{k=0}^4 x_2[k]x_1[(7-k)_5] = 4$$

$$\text{For } n=3 \Rightarrow y[3] = \sum_{k=0}^4 x_2[k]x_1[(3-k)_5] = \sum_{k=0}^4 x_2[k]x_1[(8-k)_5] = 3$$

$$\text{For } n=4 \Rightarrow y[4] = \sum_{k=0}^4 x_2[k]x_1[(4-k)_5] = \sum_{k=0}^4 x_2[k]x_1[(4-k)_5] = 3$$



(4) (25%)

$$y[n] = \sum_{k=0}^8 x_2[k]x_1[((n-k))_9], 0 \leq n \leq 8$$

$$\text{For } n=0 \Rightarrow y[0] = \sum_{k=0}^8 x_2[k]x_1[(-k)_9] = \sum_{k=0}^8 x_2[k]x_1[(9-k)_9] = 0$$

$$\text{For } n=1 \Rightarrow y[1] = \sum_{k=0}^8 x_2[k]x_1[((1-k))_9] = \sum_{k=0}^8 x_2[k]x_1[(10-k)_9] = 1$$

$$\text{For } n=2 \Rightarrow y[2] = \sum_{k=0}^8 x_2[k]x_1[((2-k))_9] = \sum_{k=0}^8 x_2[k]x_1[(11-k)_9] = 2$$

$$\text{For } n=3 \Rightarrow y[3] = \sum_{k=0}^8 x_2[k]x_1[((3-k))_9] = \sum_{k=0}^8 x_2[k]x_1[(12-k)_9] = 2$$

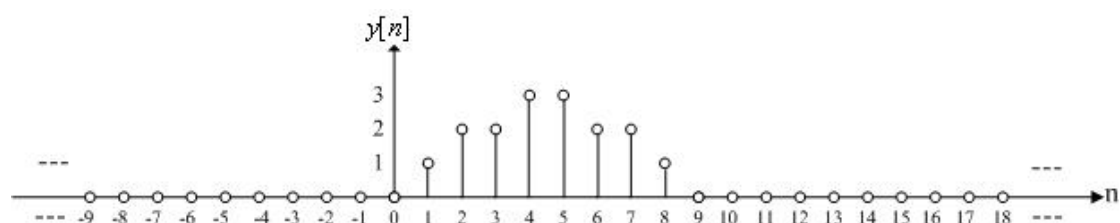
$$\text{For } n=4 \Rightarrow y[4] = \sum_{k=0}^8 x_2[k]x_1[((4-k))_9] = \sum_{k=0}^8 x_2[k]x_1[(13-k)_9] = 3$$

$$\text{For } n=5 \Rightarrow y[5] = \sum_{k=0}^8 x_2[k]x_1[((5-k))_9] = \sum_{k=0}^8 x_2[k]x_1[(14-k)_9] = 3$$

$$\text{For } n=6 \Rightarrow y[6] = \sum_{k=0}^8 x_2[k]x_1[((6-k))_9] = \sum_{k=0}^8 x_2[k]x_1[(15-k)_9] = 2$$

$$\text{For } n=7 \Rightarrow y[7] = \sum_{k=0}^8 x_2[k]x_1[((7-k))_9] = \sum_{k=0}^8 x_2[k]x_1[(16-k)_9] = 2$$

$$\text{For } n=8 \Rightarrow y[8] = \sum_{k=0}^8 x_2[k]x_1[((8-k))_9] = \sum_{k=0}^8 x_2[k]x_1[(8-k)_9] = 1$$



(4) (10%)

To compare the results of (1) and (4), it is obvious that the linear convolution  $y[n]$  equals the 9-point circular convolution  $y[n]$ .