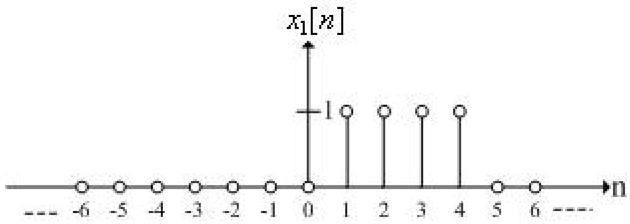
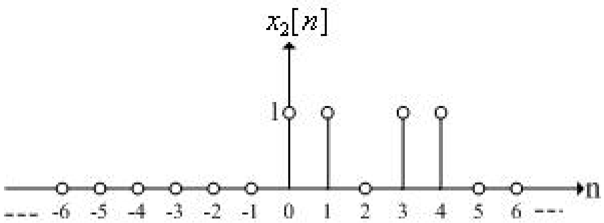
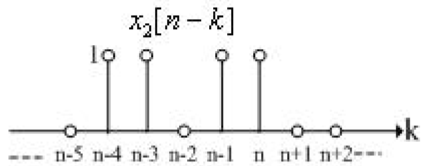
# Homework No. 7_1 Solution

1.

(1) (15%)




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

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

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

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

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

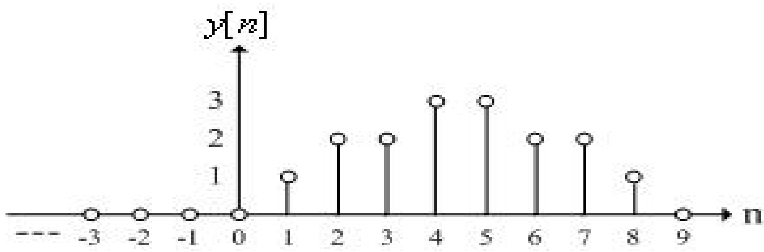
$$For\ n = 5 \Rightarrow y[5] = \sum_{k=-\infty}^{\infty} x_1[k]x_2[5-k] = 3$$

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

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

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

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



(2) (25%)

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

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

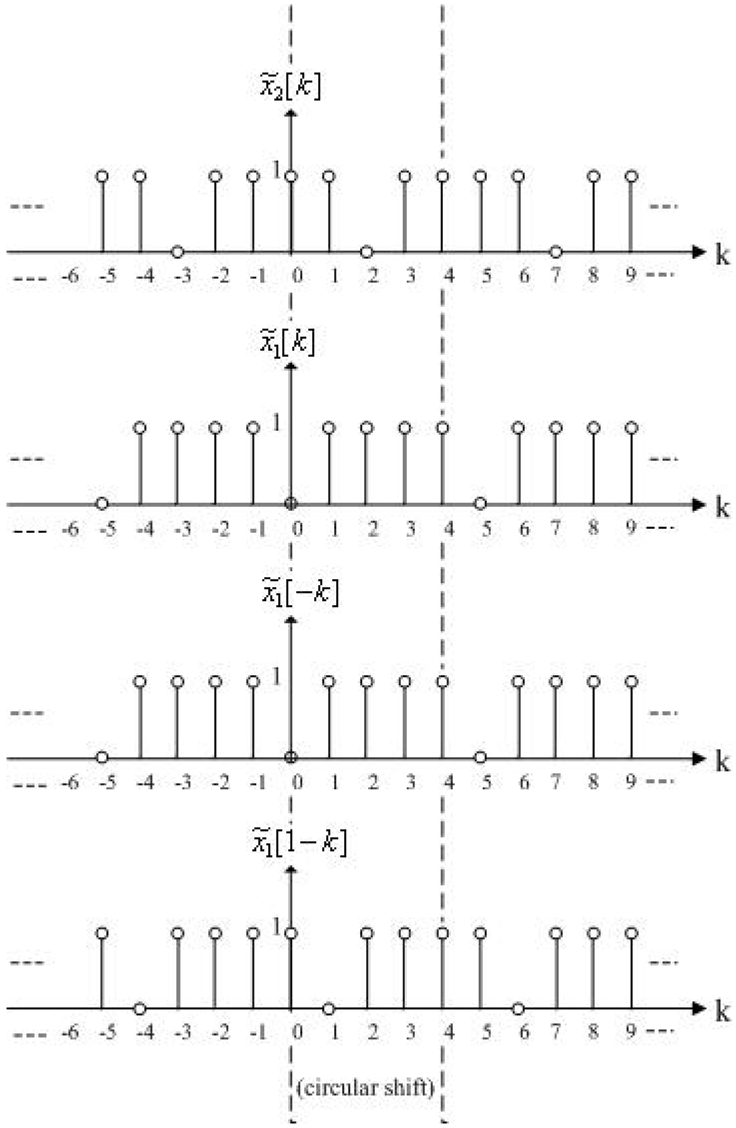
$$For\ n = 0 \Rightarrow \tilde{y}[0] = \sum_{k=0}^{4} \tilde{x}_2[k]\tilde{x}_1[-k] = 3$$

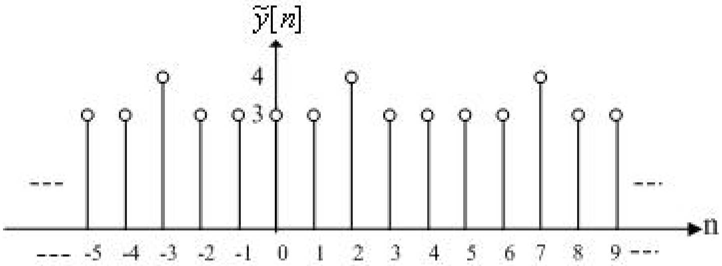
$$For\ n = 1 \Rightarrow \tilde{y}[1] = \sum_{k=0}^{4} \tilde{x}_2[k]\tilde{x}_1[1-k] = 3$$

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

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

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






(3) (25%)

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

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

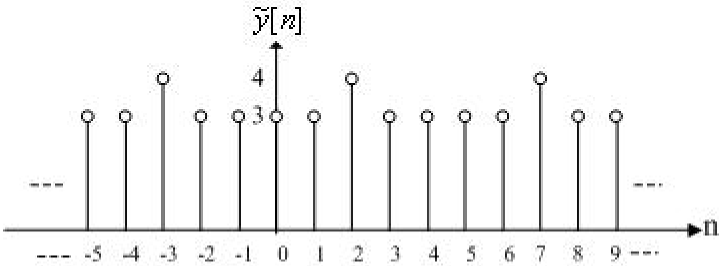
$$For\ n=0\Rightarrow \tilde{y}[0]=\sum_{k=0}^{4}x_2[k]x_1[((-k))_5]=\sum_{k=0}^{4}x_2[k]x_1[((5-k))_5]=3$$

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

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

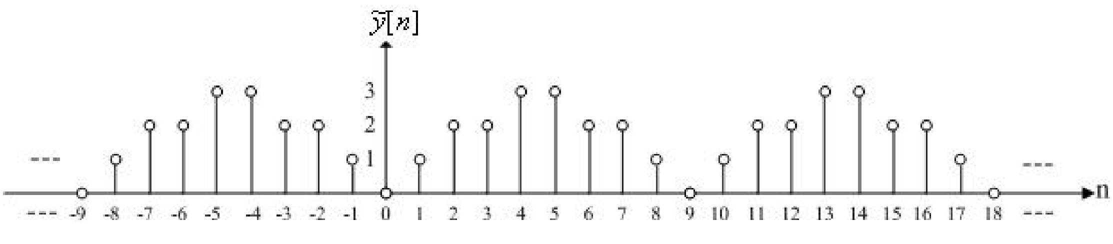
$$For\ n=3\Rightarrow \tilde{y}[3]=\sum_{k=0}^{4}x_2[k]x_1[((3-k))_5]=\sum_{k=0}^{4}x_2[k]x_1[((8-k))_5]=3$$

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




(4) (25%)

The $\tilde{y}[n]$ is a periodic sequence of period 9, so we only considered one period.



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

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

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

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

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

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

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

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

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

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

(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 $\tilde{y}[n]$ over one period.