GATE-2023 Biomedical

EE:1205 Signals and systems
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I. Question 47

Two sequences $x_1[n]$ and $x_2[n]$ are described as follows:

$$x_1[0] = x_2[0] = 1 \tag{1}$$
$$x_1[1] = x_2[2] = 2 \tag{2}$$
$$x_1[2] = x_2[1] = 1 \tag{3}$$

$x_1[n] = x_2[n] = 0$ for all $n < 0$ and $n > 2$

If $x[n]$ is obtained by convoluting $x_1[n]$ with $x_2[n]$, which of the following equations is/are TRUE?

(A) $x[2] = x[3]$

(B) $x[1] = 2$

(C) $x[4] = 3$

(D) $x[2] = 5$

II. Solution

From the data given:

$$x_1 = [1, 2, 1] \tag{4}$$
$$x_2 = [1, 1, 2] \tag{5}$$

Takin the convolution, we get

$$x = [1, 3, 5, 5, 2] \tag{6}$$
$$\tag{7}$$

Hence we get:

$$x[0] = 1 \tag{8}$$
$$x[1] = 3 \tag{9}$$
$$x[2] = 5 \tag{10}$$
$$x[3] = 5 \tag{11}$$
$$x[4] = 2 \tag{12}$$
$$\tag{13}$$

Comparing this with the options, we see that options (A) and (D) match

$\implies$ (A), (D)