

# Assignment -5 in L<sup>A</sup>T<sub>E</sub>X

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**GATE 2023 BM QN.12** For a Binomial random variable  $X$ ,  $E(X)$  and  $\text{Var}(X)$  are the expectation and variance, respectively. Which one of the following statements CANNOT be true?

S.No	$E(X)$	$\text{Var}(X)$
1	20	16
2	6	5.4
3	10	15
4	64	12.8

TABLE 1

**Solution:**

$$X \sim \text{Bin}(n, p)$$

We know ,

$$E(X) = np \quad (1)$$

$$\text{Var}(X) = np(1 - p) \quad (2)$$

$$0 \leq p \leq 1 \quad (3)$$

$$\Rightarrow -1 \leq -p \leq 0 \quad (4)$$

$$\Rightarrow 0 \leq 1 - p \leq 1 \quad (5)$$

$$\Rightarrow np(1 - p) \leq np \quad (6)$$

Therefore,

$$\text{Var}(X) \leq E(X) \quad (7)$$

From the four options, the statement that cannot be true is option (3)