AI1103 - Assignment 3

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PROBLEM :

3. The mean and variance, respectively of a binomial distribution for n independent trials with the probability of success as p, are
(A) $\sqrt{np}$, np(1-2p)
(B) $\sqrt{np}$, $\sqrt{np(1-p)}$
(C) np, np
(D) np, np(1-p)

SOLUTION

Let $X_1, X_2, X_3, ..., X_n$ be the random variable for n independent trials

Expected Value for n trials :

$$E(X_i) = X_i p_i$$
$$E(X_i) = p \tag{1}$$

We know that,

$$E(X) = \sum_{i=1}^{n} E(X_i)$$
$$E(X) = np \tag{2}$$

Mean of a binomial distribution for n independent trials is **np**.

Now,

$$E(X_i^2) = X_i^2 p_i$$
$$E(X_i^2) = p \tag{3}$$

For variance,

$$Var(X_i) = E(X_i^2) - E(X_i)^2 \tag{4}$$
$$Var(X_i) = p - p^2 \tag{5}$$

We can add Var(X_i) to get Var(X) as these are independent trials

$$Var(X) = \sum_{i=1}^{n} Var(X_i)$$
$$Var(X) = n(p - p^2)$$
$$Var(X) = np(1 - p) \tag{6}$$

Variance of a binomial distribution for n independent trials is **np(1-p)**.

Hence, (D) is correct option.