

# 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)  $np$ ,  $np(1-p)$

We can add  $\text{Var}(X_i)$  to get  $\text{Var}(X)$  as these are independent trials

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

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

## SOLUTION

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

Expected Value for n trials :

$$\begin{aligned}E(X_i) &= X_i \cdot p_i \\ E(X_i) &= p\end{aligned}\tag{1}$$

We know that,

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

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

Now,

$$\begin{aligned}E(X_i^2) &= X_i^2 \cdot p_i \\ E(X_i^2) &= p\end{aligned}\tag{3}$$

For variance,

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

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