

AI1110 Assignment-1

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Abstract—This document provides the solution to question 14 in Chapter 13 of the 12th grade NCERT textbook, Exercise 13.5.

Question :

In a box containing 100 bulbs, 10 are defective. The probability that out of a sample of 5 bulbs, none is defective is

- (A) 10^{-1}
- (B) $\left(\frac{1}{2}\right)^5$
- (C) $\left(\frac{9}{10}\right)^5$
- (D) $\frac{9}{10}$

Solution :

Total Bulbs	Defective	Non-Defective
100	10	90

TABLE 0
GIVEN INFORMATION

Let X be a random variable that represents the number of defective bulbs.

This experiment of picking bulbs follows the binomial distribution.

So,

$$\Pr(X = k) = \binom{n}{k} p^k (1 - p)^{n-k} \quad (1)$$

where,

$$n = \text{sample size} = 5 \quad (2)$$

$$k = \text{number of defective bulbs in the sample} = 0 \quad (3)$$

$$p = \frac{\text{No. of defective bulbs}}{\text{Total no. of bulbs}} = \frac{10}{100} = \frac{1}{10} \quad (4)$$

We need to find the probability that no bulb is defective i.e $\Pr(X = 0)$.

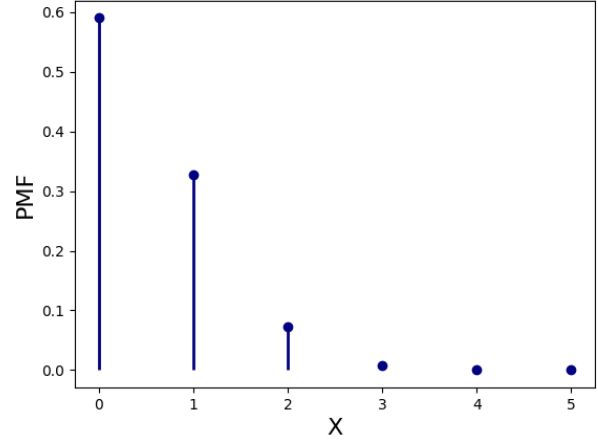


Fig. 0. PMF Plot

$$\Pr(X = 0) = \binom{5}{0} \left(\frac{1}{10}\right)^0 \left(1 - \frac{1}{10}\right)^{5-0} \quad (5)$$

$$= 1 \times 1 \times \left(\frac{9}{10}\right)^5 \quad (6)$$

$$= \left(\frac{9}{10}\right)^5 \approx 0.59 \quad (7)$$

Therefore, (C) is the correct answer.