

Bonus Question

AI1110: Probability and Random Variables

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Question:

It is known that 10% of certain articles manufactured are defective. What is the probability that in a random sample space of 12 such articles, 9 are defective?

Solution:

This experiment has a Binomial Distribution with $n = 12$ and $p = 0.1$.

Let, E be the event that exactly 9 articles are defective.

The mean and standard deviation of the Binomial distribution are

$$\mu = np \quad (1)$$

$$\mu = 12 \times 0.1 \quad (2)$$

$$\mu = 1.2 \quad (3)$$

$$\sigma = \sqrt{np(1-p)} \quad (4)$$

$$\sigma = \sqrt{12 \times 0.1 \times 0.9} \quad (5)$$

$$\sigma = 1.04 \quad (6)$$

z-score for the event E can be calculated as

$$z = \frac{x - np}{\sqrt{np(1-p)}} \quad (7)$$

$$z = \frac{9 - 1.2}{1.04} \quad (8)$$

$$z = 7.5 \quad (9)$$

From the Standard Normal Distribution table,

The probability of an event having z-score greater than 7.5 is very low and is equal to $4.338751580235112 \times 10^{-13}$

Therefore, $\Pr(E) = 4.338751580235112 \times 10^{-13}$

