AI5002: Assignment 2

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Download all Python codes from

https://github.com/Debolena/AI5002−Probability−and−Random−Variables/blob/main/Assignment_2/binomial_simulation.py

and latex-tikz codes from

https://github.com/Debolena/AI5002−Probability−and−Random−Variables/blob/main/Assignment_2/revised_with_binomial.tex

1 Problem

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

1) 10^{-1}
2) $\left(\frac{1}{2}\right)^5$
3) $\left(\frac{9}{10}\right)^5$
4) $\frac{9}{10}$

2 Solution

Total number of bulbs = 100
Number of defective bulbs = 10
Probability of a bulb being defective = probability of success = p = $\frac{10}{100} = \frac{1}{10}$
Probability of a bulb not being defective = probability of failure = q = 1-p
$= 1 - \frac{1}{10} = \frac{9}{10}$
Let X be the random variable denoting the number of defective bulbs in a sample of 5 bulbs.
Then, $X \sim Bin(n = 5, p)$
$\therefore$ Out of a sample of 5 bulbs, the probability that none are defective is

$$P(X = 0) = \binom{n}{x} p^x q^{n-x} \tag{2.0.1}$$

$$= \binom{5}{0} \left(\frac{1}{10}\right)^0 \left(\frac{9}{10}\right)^{5-0} \tag{2.0.2}$$

$$= \left(\frac{9}{10}\right)^5 \tag{2.0.3}$$

Hence, Option (3) is the required answer.