AI1103-Assignment 4

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Download all python codes from

https://github.com/AravindShounik/AI1103/blob/main/Assignment−4/Codes/assignment−4.py

and latex-tikz codes from

https://github.com/AravindShounik/AI1103/blob/main/Assignment−4/assignment−4.tex

Question gate 2018(ma)Q.11(maths section, pg.5)

An urn contains four balls, each ball having equal probability of being white or black. Three black balls are added to the urn. The probability that five balls in the urn are black is

Solution

The total number of black balls are 5
Number of black balls initially present + number of black balls added =5
So, the number of black balls initially in the urn is 5-3=2
Let X be the random variable denoting the number of black balls in the urn. So, by binomial distribution,

$$\Pr(X = 1) = p \tag{0.0.1}$$

$$\Pr(X = k) = \binom{n}{k} p^k (1-p)^{n-k} \tag{0.0.2}$$

$$k = 0, 1, 2, ..., n \tag{0.0.3}$$

For the given problem, $n = 4$ and $p = 0.5$, because there is equal probability for each ball of being white or black. For having exactly 2 black balls,
From (0.0.3),

$$\Pr(X = 2) = \binom{4}{2}\left(\frac{1}{2}\right)^2\left(\frac{1}{2}\right)^2 \tag{0.0.4}$$

$$= \frac{6}{16} \tag{0.0.5}$$

$$= \frac{3}{8} \tag{0.0.6}$$