AI1103 Assignment-1

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PROBLEM 1.5

The probability that a student is not a swimmer is $\frac{1}{5}$. Then the probability that out of five students, four are swimmers is

1) $^5C_4 \left(\frac{4}{5}\right)^4 \left(\frac{1}{5}\right)$
2) $\left(\frac{4}{5}\right)^4 \left(\frac{1}{5}\right)$
3) $^5C_1 \left(\frac{4}{5}\right)^4 \left(\frac{1}{5}\right)$
4) None of these

SOLUTION

Being 'swimmer' and being 'non swimmer' are mutually exclusive,

- Probability of 'non swimmer' = q = $\frac{1}{5}$
- Probability of 'swimmer' = p = 1- q = $\frac{4}{5}$
- Total number of students = n = 5
- Total number of swimmers = l = 4

Let K be a random variable representing number of students who are 'swimmer' in a given sample.
So K has a binomial distribution :

$$\Pr(K = l) = {}^nC_l(q)^{n-l}(p)^l \qquad (0.0.1)$$

$$\Pr(K = 4) = {}^5C_4 \left(\frac{1}{5}\right)^1 \left(\frac{4}{5}\right)^4 \qquad (0.0.2)$$

As per the property of permutation and combination,

$$^nC_l = {}^nC_{n-l} \qquad (0.0.3)$$

$$\implies \Pr(K = 4) = {}^5C_1 \left(\frac{1}{5}\right)^1 \left(\frac{4}{5}\right)^4 \qquad (0.0.4)$$

$$\implies \Pr(K = 4) = 0.4096 \qquad (0.0.5)$$

The probability that 4 students are 'swimmer' out of a random sample of 5 students is 0.4096.
Thus options 1) and 3) are correct