

Assignment 2

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Download all python codes from

<https://github.com/gaureeshk/assignment2/blob/main/Codes/assignment2.py>

and latex-tikz codes from

<https://github.com/gaureeshk/assignment2/blob/main/assignment2.tex>

1 PROBLEM

For each element in a set of size $2n$, an unbiased coin is tossed. The $2n$ coin tosses are independent. An element is chosen if the corresponding coin toss were head. The probability that exactly n elements are chosen is:

- (A) $\frac{{}^{2n}C_n}{4^n}$ (B) $\frac{{}^{2n}C_n}{2^n}$ (C) $\frac{1}{{}^{2n}C_n}$ (D) $\frac{1}{2}$

2 SOLUTION

The number of elements chosen is equal to the number of heads obtained by $2n$ coin tosses. Let X be a random variable with value of X equal to the number of heads obtained.

Probability of getting a head, $p = \frac{1}{2}$

Probability of getting a tail, $q = \frac{1}{2}$

Probability that n elements are chosen out of $2n$ elements is $\Pr(X = n)$

From binomial distribution we know that,

$$\Pr(X = r) = {}^{2n}C_r p^r q^{2n-r} \quad (2.0.1)$$

$$\Pr(X = n) = {}^{2n}C_n \times \left(\frac{1}{2}\right)^n \times \left(\frac{1}{2}\right)^n \quad (2.0.2)$$

$$= \frac{{}^{2n}C_n}{4^n} \quad (2.0.3)$$

Hence option (A) is correct.