Assignment 2

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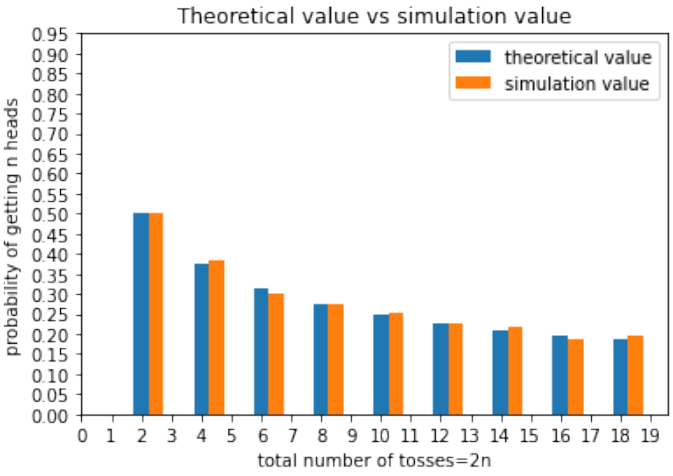
Download all python codes from

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:

1) $\frac{^{2n}C_n}{4^n}$

2) $\frac{^{2n}C_n}{2^n}$

3) $\frac{1}{^{2n}C_n}$

4) $\frac{1}{2}$

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,

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

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

$$= \frac{^{2n}C_n}{4^n} \tag{2.0.3}$$

Hence option (A) is correct.