

Assignment 1

Ncert Exemplar

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I. QUESTION 10.13.2.10

I toss three coins together. The possible outcomes are no heads, 1 heads, 2 heads and 3 heads. So, I say that probability of no heads is $1/4$. What's wrong with this conclusion

Solution:

Let, X_i be the sequence of independent Bernoulli random variables

$$X_i = \begin{cases} 1, & \text{Heads} \\ 0, & \text{Tails} \end{cases} \quad (1)$$

and X be summation of all sequences

$$X = \sum_{i=0}^n X_i \quad (2)$$

which means,

$$p_X(k) = \begin{cases} \frac{1}{2} & = p & k = 1 \\ \frac{1}{2} & = q & k = 0 \end{cases} \quad (3)$$

For number of trials be n and the pmf of getting k heads is given by:

$$p_X(k) = {}^nC_k (p)^k (q)^{n-k} \quad (4)$$

$$= {}^nC_k (0.5)^k (0.5)^{n-k} \quad (5)$$

referring to equation (5), for $n = 3$ and $k = 0$:

$$p_X(0) = {}^3C_0 (0.5)^3 (0.5)^0 \quad (6)$$

$$= \left(\frac{3!}{(3-0)!(0)!} \right) (0.5)^3 \quad (7)$$

$$= \left(\frac{3!}{3!} \right) \left(\frac{1}{8} \right) \quad (8)$$

$$= \frac{1}{8} \quad (9)$$

Hence, the given statement is wrong ($\because \frac{1}{8} \neq \frac{1}{4}$)