Assignment 1
Ncert Exampler

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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, Isay that probability of no heads is 1/4. What's wrong with this conclusion

Solution:

Let, $p_X(X_i)$ be the sequence of independent Bernoulli random varibles.

$$X_i = \begin{cases} 1, & \text{coin toss result in a Heads} \\ 0, & \text{result in Tails} \end{cases} \tag{1}$$

which means

$$p_X(X_i = 1) = 0.5 \tag{2}$$
$$p_X(X_i = 0) = 0.5 \tag{3}$$

To find the probability of getting no head after tossing coin three times, we use binomial distribution formula:

$$p_X(Z = k) = {}^{n}C_k \times q^{n-k} \times p^k \tag{4}$$

So,

$$p_X(Z = 0) = {}^{3}C_0 \times \left(\frac{1}{2}\right)^{(3-0)} \times \left(\frac{1}{2}\right)^{0} \tag{5}$$
$$= \frac{3!}{(3-0)! \times 0!} \times \frac{1}{2}^{3} \tag{6}$$
$$= \frac{3!}{3! \times 1} \times \frac{1}{8} \tag{7}$$
$$= \frac{1}{8} \tag{8}$$
$$\therefore p_x(\textit{getting no heads}) = \frac{1}{8} \tag{9}$$

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