Probability & Random Variables
AI1110

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Question

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

Solution

Let the coin be fair.
Let random variable X no of heads
The binomial dristribution is,

$$p_X(r) = \binom{n}{r} p^r q^{n-r} \tag{1}$$

Parameter	Value	Description
n	3	no of coin tosses
X	0	no of heads
p	$\left(\frac{1}{2}\right)$	probability of getting heads
q	$\left(\frac{1}{2}\right)$	probability of getting tails

then pmf would be,

$$p_X(r) = \binom{n}{r} (\frac{1}{2})^n \tag{2}$$

According to the narrator,

$$p_X(0) = \frac{1}{4} \tag{3}$$

The probability of no heads in the outcome is.

$$p_X(0) = \binom{3}{0} (\frac{1}{2})^3 \tag{4}$$

$$= (\frac{1}{2})^3 \tag{5}$$

$$= \frac{1}{8} \tag{6}$$

$\therefore$ The conclusion is wrong .