AI1110 Assignment 1

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EE22BTECH11215

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Question: 10.13.2.12 Sushma tosses a coin 3 times and gets tail each time. Do you think that the outcome of next toss will be a tail? Give reasons.
Solution: As the coin is tossed 3 times and gets a tail each time but it is not necessary that 4th time will be a tail. It may be either tail or head in any further toss.

Let X be the random variable for the occarance of tail. In this binomial distribution, $n = 4$.

$$\Pr(X = r) = {}^{n}C_{r} p^{r} q^{n-r} \tag{1}$$

where,

$$X \in \{0, 1, 2, 3\} \tag{2}$$

$p = q = \frac{1}{2}$

$$\Pr(X = 0) = {}^{3}C_{0} \left(\frac{1}{2}\right)^{0} \left(\frac{1}{2}\right)^{3} = \frac{1}{8} \tag{3}$$

$$\Pr(X = 1) = {}^{3}C_{1} \left(\frac{1}{2}\right)^{1} \left(\frac{1}{2}\right)^{2} = \frac{3}{8} \tag{4}$$

$$\Pr(X = 2) = {}^{3}C_{2} \left(\frac{1}{2}\right)^{2} \left(\frac{1}{2}\right)^{1} = \frac{3}{8} \tag{5}$$

$$\Pr(X = 3) = {}^{3}C_{3} \left(\frac{1}{2}\right)^{3} \left(\frac{1}{2}\right)^{0} = \frac{1}{8} \tag{6}$$

Probability of heads on fourth toss for first time = Probability of tails till third toss $\times \frac{1}{2} = \frac{1}{8} \times \frac{1}{2} = \frac{1}{16}$. As the coin is unbiased, Probability of $Head = Tail = \frac{1}{2}$ in every single case.

Hence, the given statement is false.