

Assignment 4

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Question : NCERT Class 12 Exercise 13.3 Problem 4

Suppose a girl throws a die. if she gets a 5 or 6, she tosses a coin three times and notes the number of heads. if she gets 1, 2, 3 or 4, she tosses a coin once and notes whether a head or tail is obtained. If she obtained exactly one head, what is the probability that she threw 1, 2, 3 or 4 with the die?

Solution

Let us define random variables X, Y , where $X, Y \in \{0, 1\}$, such that

Random Variable	Value	Description
X	0	dice shows 5,6
X	1	dice shows 1,2,3 or 4
Y	0	number of heads is 1
Y	1	number of heads are more than 1

Table: RANDOM VARIABLES

from the given data

$$P_X(0) = \frac{2}{6} \quad (1)$$

$$P_X(1) = \frac{4}{6} \quad (2)$$

$$P_Y(0) = \frac{1}{2} \quad (3)$$

$$P_Y(1) = \frac{3}{8} \quad (4)$$

From Bayes theorem ,

$$\Rightarrow P_{X/Y}(1/0) = \frac{P((X=1)(Y=0))}{P_Y(0)} \quad (5)$$

$$\Rightarrow P_{X/Y}(1/0) = \frac{P_X(1) \times P_{Y/X}(0/1)}{P_Y(0)} \quad (6)$$

$$\Rightarrow P_{X/Y}(1/0) = \frac{P_X(1) \times P_{Y/X}(0/1)}{P_X(1) \times P_{Y/X}(0/1) + P_X(1) \times P_{Y/X}(1/1)} \quad (7)$$

$$\Rightarrow P_{X/Y}(1/0) = \frac{\frac{4}{6} \times \frac{1}{2}}{\frac{4}{6} \times \frac{1}{2} + \frac{2}{6} \times \frac{3}{8}} \quad (8)$$

$$\Rightarrow P_{X/Y}(1/0) = \frac{8}{11} \quad (9)$$

\therefore The probability that she threw 1,2,3 or 4 with the die is $\frac{8}{11}$.