

Assignment-6

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Question

A man is known to speak truth 3 out of 4 times. He throws a die and reports that it is a six. Find the probability that it is actually a six.

Solution

Let the event that the man reports the result to be six be E .

The event that six actually occurs on the die be X and \bar{X} be the event that six does not occur.

Then,

$$\text{Probability that die rolls six} = P(X) = \frac{1}{6} \quad (1)$$

$$\text{Probability that die does not roll six} = P(\bar{X}) = \frac{5}{6} \quad (2)$$

Probabilities when the man reports the result to be six,

$$\text{Probability that six actually occurs} = P(E|X) = \frac{3}{4} \quad (3)$$

$$\text{Probability that it is not a six} = P(E|\bar{X}) = \frac{1}{4} \quad (4)$$

Now by Bayes's Formula we get,

Probability that the man reports the result to be six is actually a six,

$$P(X|E) = \frac{P(X) \times P(E|X)}{P(X) \times P(E|X) + P(\bar{X}) \times P(E|\bar{X})} \quad (5)$$

Now using the values from (1), (2), (3) and (4),

$$P(X|E) = \frac{\frac{1}{6} \times \frac{3}{4}}{\frac{1}{6} \times \frac{3}{4} + \frac{5}{6} \times \frac{1}{4}} \quad (6)$$

$$= \frac{\frac{3}{24}}{\frac{3}{24} + \frac{5}{24}} \quad (7)$$

$$= \frac{\frac{3}{24}}{\frac{8}{24}} \quad (8)$$

$$= \frac{3}{8} \quad (9)$$