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Assignment 6

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CBSE Probability Grade 12

Exercise 13.2.5: A die marked 1,2,3 in red and 4,5,6 in green is tossed. Let A be the event, 'the number is even', and B be the event, 'the number is red'. Are A and B independent?

Solution: Let the random variable X denote the number that appears on rolling the die. The sample space is $S = \{1, 2, 3, 4, 5, 6\}$. Hence, using pmf from Fig.1

Event A: The number is even The sample space for event A is $\{2,4,6\}$.

$$\Pr\left(X \in A\right) = \sum_{i=1}^{i=3} \Pr\left(X = 2 \times i\right) \tag{1}$$

$$= 3 \times \frac{1}{6} \tag{2}$$

$$=\frac{3}{6}\tag{3}$$

Event B: The number is red The sample space for event B is $\{1, 2, 3\}$.

$$\Pr\left(X \in B\right) = \sum_{i=1}^{i=3} \Pr\left(X = i\right) \tag{5}$$

$$= 3 \times \frac{1}{6} \tag{6}$$

$$=\frac{3}{6}\tag{7}$$

$$=\frac{1}{2}\tag{8}$$

Two events A and B are independent if $\Pr\left(X \in AB\right) = \Pr\left(X \in A\right) \times \Pr\left(X \in B\right)$

$$AB = \{2\} \tag{9}$$

$$\Pr\left(X \in AB\right) = \frac{n\left(x \in AB\right)}{n\left(x \in S\right)} \tag{10}$$

$$=\frac{1}{6}\tag{11}$$

$$\Pr(X \in A) \times \Pr(X \in B) = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$

$$\neq \Pr(X \in AB) = \frac{1}{6} \quad (12)$$

Hence, A and B are dependent events.

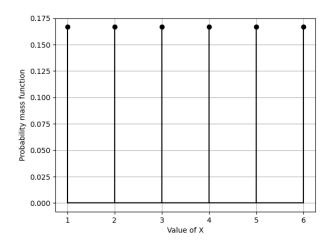


Fig. 1. Plot of the PMF of an unbiased die