Assignment 6

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CBSE Probability Grade 12

Exeercise 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 $\{2, 4, 6\}$.

$$\Pr(X \in A) = \sum_{i=1}^{i=3} \Pr(X = 2 \times i) \tag{1}$$
$$= 3 \times \frac{1}{6} \tag{2}$$
$$= \frac{3}{6} \tag{3}$$
$$= \frac{1}{2} \tag{4}$$

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

$$\Pr(X \in B) = \sum_{i=1}^{i=3} \Pr(X = i) \tag{5}$$
$$= 3 \times \frac{1}{6} \tag{6}$$
$$= \frac{3}{6} \tag{7}$$
$$= \frac{1}{2} \tag{8}$$

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

$$A \cap B = \{2\} \tag{9}$$

$$\Pr(X \in A \cap B) = \frac{n(x \in A \cap B)}{n(x \in S)} \tag{10}$$
$$= \frac{1}{6} \tag{11}$$

$$\Pr(X \in A) \times \Pr(X \in B) = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$
$$\neq \Pr(X \in A \cap B) = \frac{1}{6} \tag{12}$$

Hence, A and B are dependent events.

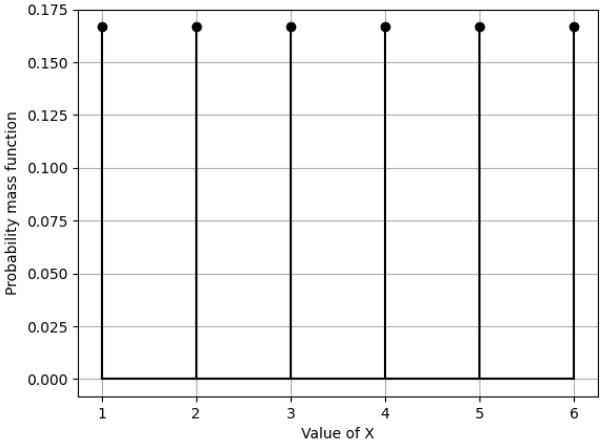

Fig. 1. Plot of the PMF of an unbiased die