

# ASSIGNMENT-12

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## 1 QUESTION No-6.16

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 ?

## 2 SOLUTION

**Lemma 2.1.** *Two events A and B are said to be independent if and only if  $\Pr(AB) = \Pr(A) \Pr(B)$ .*

Let X be a Random Variable the number on top face when die is tossed.

$$X \in \{1, 2, 3, 4, 5, 6\} \quad (2.0.1)$$

Also,

$$\Pr(X = i) = \begin{cases} \frac{1}{6} & 1 \leq i \leq 6 \\ 0 & \text{otherwise} \end{cases} \quad (2.0.2)$$

The probabilities of the various events are as follows.

$$\Pr(A) = \Pr(X = 2) + \Pr(X = 4) + \Pr(X = 6) = \frac{1}{2} \quad (2.0.3)$$

$$\Pr(B) = \Pr(X = 1) + \Pr(X = 2) + \Pr(X = 3) = \frac{1}{2} \quad (2.0.4)$$

$$\Pr(AB) = \Pr(X = 2) = \frac{1}{6} \quad (2.0.5)$$

$$\Pr(A) \times \Pr(B) = \frac{1}{4} \quad (2.0.6)$$

Now to check whether the events are independent we use Lemma 2.1

$$\Pr(A) \times \Pr(B) \neq \Pr(AB) \quad (2.0.7)$$

Thus A and B are not independent.