Assignment 9

AI1110: Probability and Random Variables

Indian Institute of Technology Hyderabad

Ankit Saha
AI21BTECH11004

7 May 2022

CBSE Probability Grade 12

Example 10 A die is thrown. If E is the event 'the number appearing is a multiple of three' and F be the event 'the number appearing is even' then find whether E and F are independent.

Solution. Let a random variable $X \in \mathcal{X}$ where $\mathcal{X} = \{1, 2, 3, 4, 5, 6\}$ denote the number appearing on the die.

E	$X \in \{3, 6\}$
F	$X \in \{2, 4, 6\}$
EF	$X = 6$

TABLE 1

$$\Pr(E) = \Pr(X \in \{3, 6\}) \tag{1}$$
$$= \frac{n(X \in \{3, 6\})}{n(X \in \mathcal{X})} \tag{2}$$
$$= \frac{2}{6} \tag{3}$$
$$= \frac{1}{3} \tag{4}$$
$$\Pr(F) = \Pr(X \in \{2, 4, 6\}) \tag{5}$$
$$= \frac{n(X \in \{2, 4, 6\})}{n(X \in \mathcal{X})} \tag{6}$$
$$= \frac{3}{6} \tag{7}$$
$$= \frac{1}{2} \tag{8}$$
$$\Pr(E)\Pr(F) = \frac{1}{3} \times \frac{1}{2} \tag{9}$$
$$= \frac{1}{6} \tag{10}$$

Now, the probability of their intersection is given by:

$$\Pr(EF) = \Pr(X \in \{3, 6\}, X \in \{2, 4, 6\}) \tag{11}$$
$$= \Pr(X = 6) \tag{12}$$
$$= \frac{n(X = 6)}{n(X \in \mathcal{X})} \tag{13}$$
$$= \frac{1}{6} \tag{14}$$

Clearly,

$$\Pr(EF) = \Pr(E)\Pr(F) \tag{15}$$

Therefore, E and F are independent events.