Assignment 9
AI1110: Probability and Random Variables
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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

$$\Pr(X \in \{3, 6\}) = \frac{n(X \in \{3, 6\})}{n(X \in \mathcal{X})} \quad (1)$$

$$= \frac{2}{6} \quad (2)$$

$$= \frac{1}{3} \quad (3)$$

$$\Pr(X \in \{2, 4, 6\}) = \frac{n(X \in \{2, 4, 6\})}{n(X \in \mathcal{X})} \quad (4)$$

$$= \frac{3}{6} \quad (5)$$

$$= \frac{1}{2} \quad (6)$$

$$(7)$$

$$\Pr(X \in \{3, 6\}, X \in \{2, 4, 6\})$$
$$= \frac{n(X \in \{3, 6\}, X \in \{2, 4, 6\})}{n(X \in \mathcal{X})}$$
$$= \frac{n(X = 6)}{n(X \in \mathcal{X})} = \frac{1}{6} \quad (8)$$

$$\Pr(X \in \{3, 6\}) \Pr(X \in \{2, 4, 6\}) = \frac{1}{3} \times \frac{1}{2} \quad (9)$$
$$= \frac{1}{6} \quad (10)$$

Clearly,

$$\Pr(X \in \{3, 6\}, X \in \{2, 4, 6\})$$
$$= \Pr(X \in \{3, 6\}) \Pr(X \in \{2, 4, 6\}) \quad (11)$$

Therefore, E and F are independent events.