

2 Refer to question 1 above. If the die were fair, determine whether or not the events  $A$  and  $B$  are independent.

### 💡 Thinking Process

*In a fair die, we have equally likely outcomes. So, with the given events  $A$  and  $B$ , we first find  $P(A)$ ,  $P(B)$  and  $P(A \cap B)$  and then check whether they are dependent or independent.*

Referring to the above solution, we have

$$A = \{(1, 1), (2, 2), (3, 3), (4, 4), (5, 5), (6, 6)\}$$

$$\Rightarrow n(A) = 6 \text{ and } n(S) = 6^2 = 36 \quad [\text{where, } S \text{ is sample space}]$$

$$\therefore P(A) = \frac{n(A)}{n(S)} = \frac{6}{36} = \frac{1}{6}$$

and  $B = \{(4, 6), (6, 4), (5, 5), (6, 5), (5, 6), (6, 6)\}$

$$\Rightarrow n(B) = 6 \text{ and } n(S) = 6^2 = 36$$

$$\therefore P(B) = \frac{n(B)}{n(S)} = \frac{6}{36} = \frac{1}{6}$$

Also,  $A \cap B = \{(5, 5), (6, 6)\}$

$$\Rightarrow n(A \cap B) = 2 \text{ and } n(S) = 36$$

$$\therefore P(A \cap B) = \frac{2}{36} = \frac{1}{18}$$

Also,  $P(A) \cdot P(B) = \frac{1}{36}$

Thus,  $P(A \cap B) \neq P(A) \cdot P(B)$   $\left[ \because \frac{1}{18} \neq \frac{1}{36} \right]$

So, we can say that both  $A$  and  $B$  are not independent events.