ASSIGNMENT-13

Unnati Gupta

Download all python codes from

https://github.com/unnatigupta2320/Assignment_13

and latex-tikz codes from

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1 Question No-6.20

An unbiased dice is thrown twice. Let the event A be "odd number on the first throw" and B be "Odd number on second throw". Check the independence of event A and B.

2 Solution

Lemma 2.1. *Two events are independent if knowing one event occurred doesn't change the probability of the other event.*
$\therefore$ *A and B are said to be independent if and only if:-*

$$\Pr(AB) = \Pr(A)\Pr(B) \tag{2.0.1}$$

1) Let X be the random variable representing the no. we get when a dice is thrown.

$$X \epsilon \{1, 2, 3, 4, 5, 6\} \tag{2.0.2}$$

2) According to question,the events are:-

Events	Description
A	Odd number on first throw
B	Odd number on second throw
AB	Odd Numbers appears on both throws

3) For the event **A** : Odd number on first throw
   - The probability of odd number on first throw is-

$$\Pr(A) = \Pr(X = 1) + \Pr(X = 3) + \Pr(X = 5) \tag{2.0.3}$$

$$\implies \Pr(A) = \frac{1}{6} + \frac{1}{6} + \frac{1}{6} \tag{2.0.4}$$

$$\implies \Pr(A) = \frac{3}{6} \tag{2.0.5}$$

$$\implies \Pr(A) = \frac{1}{2} \tag{2.0.6}$$

4) For the event **B**: Odd number on second throw
   - The probability of odd number on second throw is-

$$\Pr(B) = \Pr(X = 1) + \Pr(X = 3) + \Pr(X = 5) \tag{2.0.7}$$

$$\implies \Pr(B) = \frac{1}{6} + \frac{1}{6} + \frac{1}{6} \tag{2.0.8}$$

$$\implies \Pr(B) = \frac{3}{6} \tag{2.0.9}$$

$$\implies \Pr(B) = \frac{1}{2} \tag{2.0.10}$$

5) For the event AB : Odd Numbers appears on both throw
   - The probability that odd numbers appears on both throw is-

$$\implies \Pr(AB) = \left(\frac{1}{2}\right)\left(\frac{1}{2}\right) \tag{2.0.11}$$

$$\implies \Pr(AB) = \frac{1}{4} \tag{2.0.12}$$

6) Now to check whether the events are **independent**, we use Lemma (2.1).

$$\implies \Pr(AB) = \Pr(A)\Pr(B) \tag{2.0.13}$$

7) Putting values from (2.0.6) and (2.0.10) we get,

$$\implies \Pr(AB) = \frac{1}{2} \times \frac{1}{2} \tag{2.0.14}$$

$$\implies \Pr(AB) = \frac{1}{4} \tag{2.0.15}$$

This is equal to value in equation (2.0.12).
Hence, the events are **independent**.