AI5002 - Assignment 9

Tuhin Dutta
ai21mtech02002

Download code and LaTeX from below hyperlinks
1. Code/AxiomProb_6_20.py
2. LaTeX

***Problem* 6.20**

An unbiased die is thrown twice. Let the event A be 'odd number on the first throw' and B be event 'odd number on the second throw'. Check the independence of the events A and B.

Solution

We know two events are said to be independent if P(A ∩ B) = P(A).P(B)

Let us define the random variable S as 'Throwing a unbiased dice twice'. The sample space of random variable S is given by -
S = {
(1, 1) (1, 2) (1, 3) (1, 4) (1, 5) (1, 6),
(2, 1) (2, 2) (2, 3) (2, 4) (2, 5) (2, 6),
(3, 1) (3, 2) (3, 3) (3, 4) (3, 5) (3, 6),
(4, 1) (4, 2) (4, 3) (4, 4) (4, 5) (4, 6),
(5, 1) (5, 2) (5, 3) (5, 4) (5, 5) (5, 6),
(6, 1) (6, 2) (6, 3) (6, 4) (6, 5) (6, 6)}

We define two random variables X and Y where X denotes 'Throwing an odd number on first throw' and Y denotes 'Throwing an odd number on second throw'.
The sample space of X is given by -
X = {
(1, 1) (1, 2) (1, 3) (1, 4) (1, 5) (1, 6),
(3, 1) (3, 2) (3, 3) (3, 4) (3, 5) (3, 6),
(5, 1) (5, 2) (5, 3) (5, 4) (5, 5) (5, 6)}
Probability of odd number on the first throw

$$P(X) = \frac{n(X)}{n(S)} = \frac{18}{36} = \frac{1}{2} \tag{0.0.1}$$

The sample space of random variable Y is given by -
Y = {
(1, 1) (1, 3) (1, 5),
(2, 1) (2, 3) (2, 5),
(3, 1) (3, 3) (3, 5),
(4, 1) (4, 3) (4, 5),
(5, 1) (5, 3) (5, 5),
(6, 1) (6, 3) (6, 5)}
Probability of odd number on the second throw

$$P(Y) = \frac{n(Y)}{n(S)} = \frac{18}{36} = \frac{1}{2} \tag{0.0.2}$$

We define one more random variable Z which is defined as 'Throwing odd numbers on both first and second throws' and the sample space is given by -
Z = {
(1, 1) (1, 3) (1, 5),
(3, 1) (3, 3) (3, 5),
(5, 1) (5, 3) (5, 5)}
Probability of odd number on the first and second throw.

$$P(Z) = \frac{n(Z)}{n(S)} = \frac{9}{36} = \frac{1}{4} \tag{0.0.3}$$

Also, P(X) . P(Y) = $\frac{1}{2}.\frac{1}{2} = \frac{1}{4}$

Since,
P(Z) = P(X) . P(Y)
Therefore, X and Y are independent random variables.