PROBABILITY

1. Experiment

An operation which can produce some well-defined outcomes is called an experiment.

2. Random Experiment

An experiment in which all possible outcomes are know and the exact output cannot be predicted in advance, is called a random experiment.

Examples

i. Rolling an unbiased dice.

ii. Tossing a fair coin.

iii. Drawing a card from a pack of well-shuffled cards.

iv. Picking up a ball of certain colour from a bag containing balls of different colours.

Details:

v. When we throw a coin, then either a Head (H) or a Tail (T) appears.

vi. A dice is a solid cube, having 6 faces, marked 1, 2, 3, 4, 5, 6 respectively. When we throw a die, the outcome is the number that appears on its upper face.

vii. A pack of cards has 52 cards. It has 13 cards of each suit, name Spades, Clubs, Hearts and Diamonds.Cards of spades and clubs are black cards.Cards of hearts and diamonds are red cards. There are 4 honours of each unit. There are Kings, Queens and Jacks. These are all called face cards.

3. Sample Space:

When we perform an experiment, then the set S of all possible outcomes is called the sample space.

Examples

1. In tossing a coin, S = {H, T}

2. If two coins are tossed, the S = {HH, HT, TH, TT}.

3. In rolling a dice, we have, S = {1, 2, 3, 4, 5, 6}.

4. Event:

Any subset of a sample space is called an event.

5. Probability of Occurrence of an Event:

Let S be the sample and let E be an event.

Then, $E \subseteq S$.

$$\therefore \ P(E) = \frac{n(E)}{n(S)}.$$

6. **Results on Probability:**

. $P(S) = 1$

i. $0 \leq P(E) \leq 1$

ii. $P(\Phi) = 0$

iii. For any events A and B we have : $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

iv. If A denotes (not-A), then $P(A) = 1 - P(A)$.

Problems with solutions

1. A bag contains 2 red, 3 green and 2 blue balls. Two balls are drawn at random. What is the probability that none of the balls drawn is blue?

Solution

Total number of balls = (2 + 3 + 2) = 7.

Let S be the sample space.

Then, n(S) = Number of ways of drawing 2 balls out of 7

$= {}^7C_2$ `

$$= \frac{(7 \times 6)}{(2 \times 1)}$$

= 21.

Let E = Event of drawing 2 balls, none of which is blue.

$\therefore$ n(E) = Number of ways of drawing 2 balls out of (2 + 3) balls.

$= {}^5C_2$

$$= \frac{(5 \times 4)}{(2 \times 1)}$$

= 10.

$$\therefore\ P(E) = \frac{n(E)}{n(S)} = \frac{10}{21}.$$

2. In a box, there are 8 red, 7 blue and 6 green balls. One ball is picked up randomly. What is the probability that it is neither red nor green?

Solution

Total number of balls = (8 + 7 + 6) = 21.

Let E = event that the ball drawn is neither red nor green

= event that the ball drawn is blue.

n(E) = 7.

$P(E) = \underline{n(E)} = \underline{7} = \underline{1}.$

n(S) 21 3

3. What is the probability of getting a sum 9 from two throws of a dice?

Solution

In two throws of a dice, n(S) = (6 x 6) = 36.

Let E = event of getting a sum = {(3, 6), (4, 5), (5, 4), (6, 3)}.

$\therefore\ P(E) = \frac{n(E)}{n(S)} = \frac{4}{36} = \frac{1}{9}.$

4. Two dice are thrown simultaneously. What is the probability of getting two numbers whose product is even?

Solution

In a simultaneous throw of two dice, we have n(S) = (6 x 6) = 36.

Then, E = {(1, 2), (1, 4), (1, 6), (2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6), (3, 2), (3, 4), (3, 6), (4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6), (5, 2), (5, 4), (5, 6), (6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)}

n(E) = 27.

$P(E) = \frac{n(E)}{n(S)} = \frac{27}{36} = \frac{3}{4}.$

5. From a pack of 52 cards, two cards are drawn together at random. What is the probability of both the cards being kings?

Solution

Let S be the sample space.

Then, $n(S) = {}^{52}C_2 = \frac{(52 \times 51)}{(2 \times 1)} = 1326.$

Let E = event of getting 2 kings out of 4.

$n(E) = {}^{4}C_2 = \frac{(4 \times 3)}{(2 \times 1)} = 6.$

$P(E) = \frac{n(E)}{n(S)} = \frac{6}{1326} = \frac{1}{221}.$