PROBABILITY

Learning Objectives

- Probability
- Playing Cards

Probability

A mathematically measure of uncertainty is known as probability. If there are 'a' elementary events associated with a random experiment and 'b' of them are favourable to event 'E':

- Then the probability of occurrence of event E is denoted by P (E).

  $\therefore \quad P(E) = \frac{b}{a} \quad \Rightarrow \quad 0 \le P(E) \le 1$

- The probability of non-occurrence of event E denoted by P(E) and is defined $as\ \frac{a-b}{a}$.

  $\therefore \quad P(\bar{E}) = \frac{a-b}{a} = 1 - \frac{b}{a} = 1 - P(E)$

- $\Rightarrow \quad P(E) + P(\bar{E}) = 1$

Experiment

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

Random Experiment: An experiment in which all possible outcomes are known and exact outcome cannot be predicted is called a random experiment.

Example: Rolling an unbiased dice has all six outcomes (1, 2, 3, 4, 5, 6) known but exact outcome can be predicted.
Outcome: The result of a random experiment is called an outcome,
Sample Space: The set of all possible outcomes of a random experiment is known as sample space.

Example: The sample space in throwing of a dice is the set (1, 2, 3, 4, 5, 6).
Trial: The performance of a random experiment is called a trial.

Example: The tossing of a coin is called trial.

Event

An event is a set of experimental outcomes, or in other words it is a subset of sample space.

Example: On tossing of a dice, let A denotes the event of even number appears on top A: {2, 4, 6}.
Mutually Exclusive Events: Two or more events are said to be mutually exclusive if the occurrence of any one excludes the happening of other in the same experiment. E.g. On tossing of a coin is head occur, then it prevents happing of tail, in the same single experiment.
Exhaustive Events: All possible outcomes of an event are known as exhaustive events. Example:
In a throw of single dice the exhaustive events are six {1, 2, 3, 4, 5, 6}.
Equally Likely Event: Two or more events are said to be equally likely if the chances of their happening are equal.

Example: On throwing an unbiased coin, probability of getting Head and Tail are equal.

Playing Cards

- Total number of card are 52.
- There are 13 cards of each suit named Diamond, Hearts, Clubs and Spades.
- Out of which Hearts and diamonds are red cards.
- Spades and Clubs are black cards.
- There are four face cards each in number four Ace, King, Queen and Jack.

Black Suit (26)	**Red Suit (26)**
Spade (13) & Club (13)	Diamond (13) & Heart (13)

- Each Spade, Club, Diamond, Heart has 9 digit cards 2, 3, 4, 5, 6, 7, 8, 9 and 10.
- There are 4 Honour cards each Spade, Club, Diamond, Heart contains 4 numbers of Honours cards Ace, King, Queen and Jack.

Commonly Asked Questions

- In a through of a coin find the probability of getting a tail.

  (a) $\frac{1}{2}$ (b) $\frac{3}{2}$
  (c) $\frac{1}{3}$ (d) $\frac{1}{4}$
  (e) None of these

  Answer: (a)

  Explanation: In this case sample space, S = {H, T}, Event E = {T}

  $$\therefore P(E)=\frac{n(E)}{n(S)}=\frac{1}{2}$$

- An unbiased die is tossed. Find the probability of getting a multiple of 2.

  (a) $\frac{1}{4}$ (b) $\frac{3}{2}$
  (c) $\frac{1}{3}$ (d) $\frac{1}{2}$

  Answer (d)

  Explanation: S = {1, 2, 3, 4, 5, 6}, Event E = {2, 4, 6} multiple of 2

  $$\therefore P(E)=\frac{n(E)}{n(S)}=\frac{3}{6}=\frac{1}{2}$$

- An unbiased die is tossed. Find the probability of getting a number less than or equal to 4.

  (a) $\frac{1}{3}$ (b) $\frac{2}{5}$
  (c) $\frac{2}{3}$ (d) $\frac{1}{6}$
  (e) None of these

  Answer: (c)

  Explanation: Here Sample space S = {1, 2, 3, 4, 5, 6}, Event E = {1, 2, 3, 4} number- less than or equal to 4.

  $$\therefore P(E)=\frac{n(E)}{n(S)}=\frac{4}{6}=\frac{2}{3}$$

- What is the chance that a leap year selected randomly will have 53 Sundays?

(a) $\frac{2}{5}$ (b) $\frac{2}{7}$

(c) $\frac{1}{7}$ (d) $\frac{2}{4}$

(e) None of these

Answer: (b)
Explanation: A leap year has 366 days, out of which there are 52 weeks and 2 more days.
2 more days can be (Sunday, Monday), (Monday, Tuesday), (Tuesday, Wednesday), (Wednesday, Thursday), (Thursday, Friday), (Friday, Saturday), (Saturday, Sunday)
= n(S) = 7
So, (Sunday, Monday) and (Saturday, Sunday) = n (E) = 2, therefore chances that a leap year selected randomly will have 53 Sundays:

$$\therefore P(E)=\frac{n(E)}{n(S)}=\frac{2}{7}$$

- What is the chance that a normal year selected randomly will have 53 Sundays?

(a) $\frac{1}{7}$ (b) $\frac{2}{7}$

(c) $\frac{2}{8}$ (d) $\frac{2}{6}$

(e) None of these

Answer: (a)
Explanation: A normal year has 365 days, out of which there are 52 weeks and 1 more day
So, extra day can be Sunday, Monday, Tuesday, Wednesday, Thursday Friday, Saturday
So, n(S) = 7, n(E) = 1

$$\therefore P(E)=\frac{n(E)}{n(S)}=\frac{1}{7}$$