Introduction to Probability :-

Probability terms :- 1. Experiement or Random Experiement

2. Outcome
3. Sample Space
4. Event
5. Probability Rules (Insection, Union, Complement)

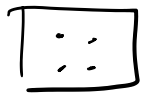
1. Experiement / Random Experiement :-

Defined as uncertain situations having multiple outcomes

eg :- 1. Tossing a coin H, T
2. Rolling a dice 1, 2, 3, 4, 5, 6
3. Whether it will rain tomorrow? Yes, No
4. Whether India will win or lose? Yes, No

Outcome :- Result of an experiment.

eg :- 1. Toss a coin :- H
exp — outcome.

2. Roll a dice :-  ← 4
exp — Outcome

Sample Space :- Collection of all possible outcomes of an experiement

eg :- 1. Tossing a coin :- H, T

$SS(Tc) = \underbrace{\{H, T\}}_{\text{Sample Space.}}$ $\boxed{n(S) = 2}$

2. Tossing 2 coins simultaneously :- HH, HT, TH, TT

$SS(Tc2) = \{HH, HT, TH, TT\}$

$\boxed{n(SS) = 4}$

$n(S) = 4$

2. Rolling a dice :-

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

$$n(S) = 6$$

3. Roling 2 dice Simultaneously :- $n(S) = 36$

$$SS(RD) = \{(1,1), (1,2), (1,3), (1,4), (1,5), (1,6),$$
$$(2,1), (2,2), (2,3), (2,4), (2,5), (2,6),$$
$$(3) \ldots$$
$$\ldots (6,1), (6,2), (6,3), (6,4), (6,5), (6,6)\}$$

4. Event :- Subset of a Sample Space.

eg:- (1) A coin is tossed & head turns up.

exp

$S(TC) = \{H, T\} \in H$ ↙ Event

5. WC match both Ind & Aus.

$SS = \{$ India win, Aus win, Tie, Rain Stopped Play$\}$

↑ Aus win ∈ Event

eg:- 1. Tossing a coin & head turns up.

$S(T) = \{H, T\}$ $n(S) = 2$

Event A :- Head turns up.

$S(A) = \{H\}$ $n(S(A)) = 1$

eg 2 :- We roll a dice.

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

Event A :- Even nos. turns up.

$S(A) = \{2, 4, 6\}$ $n(S(A)) = 3.$

Event B :- Only prime nos. turn up.

$S(B) :- \{2, 3, 5\}$

$n(S(B)) = 3.$

1 is neither prime nor composite.

$2 = 2 \times 1$

$3 = 3 \times 1$ $5 = 5 \times 1$

Exp :- Tossing 2 coins

$S(T_{2C}) = \{(H,H), (H,T), (T,H), (T,T)\}$

$n(S) = 4$

Event A :- Atleast 1 head turning up

$S(A) = \{(H,H), (H,T), (T,H)\}$

$n(S) = 3$

Event B :- No. tail turns up.

$S(B) = \{(H,H)\} = n(S(B)) = 1$

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eg:- Roll 2 dice SS :-

	1	2	3	4	5	6
1	(1,1)	(1,2)	(1,3)	(1,4)	(1,5)	(1,6)
2	(2,1)	(2,2)	(2,3)	(2,4)	(2,5)	(2,6)
3	(3,1)	(3,2)	(3,3)	(3,4)	(3,5)	(3,6)
4	(4,1)	(4,2)	(4,3)	(4,4)	(4,5)	(4,6)
5	(5,1)	(5,2)	(5,3)	(5,4)	(5,5)	(5,6)
6	(6,1)	(6,2)	(6,3)	(6,4)	(6,5)	(6,6)

Event: A :- The sum of two dice turns up as 10

$S(A) :- \{(5,5), (6,4), (4,6)\} = n(S(A)) = 3$

Probability :- $\frac{\text{no. of elements in Sample Space of an event}}{\text{total sample space}}$

$$0 \leq P(A) \leq 1$$

eg:- 1 Exp:- Rolling a dice & Tossing a coin simultaneously

$S = \{(H,1), (H,2), (H,3), (H,4), (H,5), (H,6), (T,1), (T,2), (T,3), (T,4), (T,5), (T,6)\}$

$n(S) = 12$

Event A:- Only Head turning up

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

$n(S(A)) = 6$

$P(A) = \frac{n(S(A))}{n(S)} = \frac{6}{12} = \frac{1}{2}$

$P(A) = \frac{6}{12}$

Event B:- Get only even nos. on the dice

$S(B) = \{(H,2), (H,4), (H,6), (T,2), (T,4), (T,6)\}$

$n(S(B)) = 6$

$P(B) = \frac{6}{}$

$$P(B) = \frac{6}{12}$$

eg:- Rolling a dice simultaneously

$1,1 = \frac{1+1}{2}$

$= \frac{2}{2} = 1$ ✗

$S.S =$

	1	2	3	4	5	6
1	(1,1)	(1,2)	(1,3)	(1,4)	(1,5)	(1,6)
2	(2,1)	(2,2)	(2,3)	(2,4)	(2,5)	(2,6)
3	(3,1)	(3,2)	(3,3)	(3,4)	(3,5)	(3,6)
4	(4,1)	(4,2)	(4,3)	(4,4)	(4,5)	(4,6)
5	(5,1)	(5,2)	(5,3)	(5,4)	(5,5)	(5,6)
6	(6,1)	(6,2)	(6,3)	(6,4)	(6,5)	(6,6)

$n(S.S) = 36$

Event A :- Getting an even no. when you add both nos. & divide by 2.

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

$n(S(A)) = 9$

$P(A) = \frac{9}{36}$

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Probability Rules :-

1. Complement :- $\boxed{P(\bar{A}) = 1 - P(A)}$

eg :- Roll a dice :- $\{1, 2, 3, 4, 5, 6\} \Rightarrow n(S) = 6$

Event A :- Get all no. divisible by 3

$S(A) = \{3, 6\}$ $\quad n(S(A)) = 2$

$P(A) = \frac{2}{6}$

Event B :- Get all nos. not divisible by 3.

$S(B) = \{1, 2, 4, 5\}$ $\quad n(B) = 4$

$P(B) = \frac{4}{6}$

$P(B) = P(\bar{A})$

$P(A) = 2/6$ $\quad P(\bar{A}) = 4/6$

$P(\bar{A}) = 1 - P(A)$

$= 1 - \frac{2}{6} = \frac{6-2}{6} = \frac{4}{6}$

$= P(\bar{A})$