# MADE EASY
## COMPUTER SCIENCE
## Topper Handwritten Notes
## ENGINEERING MATH
### BY-PUNEET SIR

- Theory
- Explanation
- Derivation
- Example
- Shortcuts
- Previous Years Question With Solution

# Probability

**Random Experiments :-** When ever we are not sure about the outcome of an experiment then such type of experiments are called random experiment.

Coin tossing
Throwing a dice.
A baby is going to take birth.

**Sample space :-** Total no. of possible outcomes written in set form is called as sample space.

Coin : $S_C = \{H, T\}$
Dice : $S_D = \{1, 2, 3, 4, 5, 6\}$
family : $S_F = \{B, G, T\}$

**Event :-** Any subset of an sample space is known as event

**NOTE ⇒** Total no. of event associated with sample space S having cardinality 'n' = Total no. of subsets = $2^n$

Eg. $S_C = \{H, T\} \Rightarrow$ Total no. of subsets $= 2^2 = 4$

various events : $E_1 = \{H\}$ $E_2 = \{T\}$

$E_3 = \{H, T\} = S$ = sure event $E_4 = \phi$ ← Impossible event

**Sure Event / Certain event :-**
$\because S \subseteq S$, so, it is also an event & it is called sure event & $\boxed{P(S) = 1}$

**Impossible Event :-** $\because \phi \subseteq S$, so $\phi$ is also an event and it is called impossible event.

& $\boxed{P(\phi) = 0}$

**NOTE :-**

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

2)
→ Prob. : Base = 1 unit
→ Proportion : ⇒ Base = 1 unit
→ % ⇒ Base = 100 unit

2) P( given that) = 1

3) P (something occurres) = 1

4) P( Nothing occurns ) = 0

5) P( Deoth) = 1

6) P (GOD) = 1

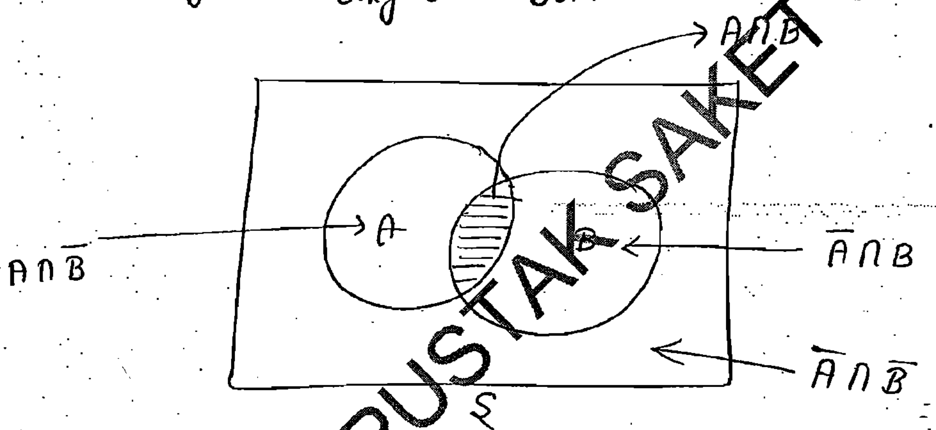
7) In this Copter we will use following notations:

(a) Either A or B or Both = At least one of A or B = $A \cup B$

(b) Both A and B = simultaneous occurrence of A & B = $A \cap B$

(c) Neither A Nor B = None of A & B = $\bar{A} \cap \bar{B}$

(d) $\underbrace{A \cap \bar{B}}_{\text{only } A} + \underbrace{\bar{A} \cap B}_{\text{only } B} + \underbrace{A \cap B}_{\text{Both}} = A \cup B$




8) Some Standard Results:-

(i) (addition Theorem) ⇒ $\boxed{P(A \cup B) = P(A) + P(B) - P(A \cap B)}$

$P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(B \cap C) - P(C \cap A) + P(A \cap B \cap C)$

ii) Multiplication Theorem ⇒

$$\boxed{P(A \cap B) = P\left(\frac{A}{B}\right) \cdot P(B)}$$

conditional prob
This is prob. of A when B is already happen.

iii) P (Niether A nor B) = 1 − P( either A or B or Both)

$$\boxed{P(\bar{A} \cap \bar{B}) = 1 - P(A \cup B)}$$

iv) again we can write,

$$P(\text{either } A \text{ or } B) = 1 - P(\text{neither } A \text{ nor } B)$$

$$P(\text{atleast one of } A \text{ or } B) = 1 - P(\text{None of } A \,\&\, B)$$

In short, $\boxed{P(\text{atleast one}) = 1 - P(\text{None})}$

9) Mutually exclusive Events:—

A and B are said to be mutually exclusive if they can not occur simultaneously.

i.e $A \cap B = \phi$ → $P(A \cap B) = 0$

→ $\boxed{P(A \cup B) = P(A) + P(B) - 0}$

Eg Dice: $S = \{1, 2, 3, 4, 5, 6\}$ → $A = \{1, 3, 5\}$

→ $B = \{2, 4, 6\}$

$\therefore A \cap B = \phi$ So, A and B are M.E.

Independent Events: If occurrence or non-occurrence of one event donot alter the occurrence or non-occurrence of other events then Events are called independent.

And in case of independent events " we can multiply the respective probability in order to find their simultaneous probability.

i.e if A & B are independent then $\boxed{P(A \cap B) = P(A) \cdot P(B)}$

or if A, B, C are independent then $P(A \cap B \cap C) = P(A) \cdot P(B) \cdot P(C)$

Que: A coin is tossed and a dice is thrown then find the probability that head will come on coin and the no. less than 5 comes on dice?

$C = \{H, T\}$ $D = \{1, 2, 3, 4, 5, 6\}$

$E_1 = \{H\}$ $E_2 = \{1, 2, 3, 4\}$

$P(E_1) = \frac{1}{2}$ $P(E_2) = \frac{4}{6} = \frac{2}{3}$

$P(E_1 \cap E_2) = \frac{1}{2} \times \frac{2}{3} = \frac{1}{3}$ ( ∵ Dice & coin are independent ⇒ $E_1$ & $E_2$ are also Indepen. )