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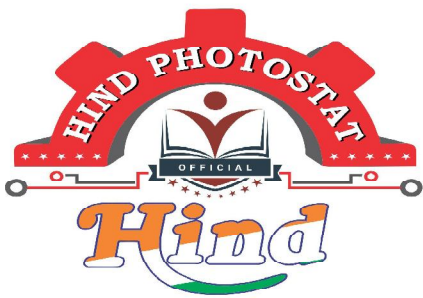
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# Probability

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:  $\xi_C = \{H, T\}$

Dice:  $\xi_D = \{1, 2, 3, 4, 5, 6\}$

family:  $\xi_F = \{B, G, T\}$

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

NOTE  $\Rightarrow$  Total no. of event associated with sample space  $\xi$  having cardinality 'n' = Total no. of subsets =  $2^n$

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

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

$E_3 = \{H, T\}$   
= sure event

$E_4 = \phi$   $\leftarrow$  Impossible event

Sure Event / Certain event:-

$\because \xi \subseteq \xi$ , so, it is also an event & it is called sure event

&  $P(\xi) = 1$

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

&  $P(\phi) = 0$

NOTE:-

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

- 2)  $\begin{cases} \rightarrow \text{Prob. : Base = 1 unit} \\ \rightarrow \text{Proportion: } \Rightarrow \text{Base = 1 unit} \\ \rightarrow \% \Rightarrow \text{Base = 100 unit} \end{cases}$

2)  $P(\text{given that}) = 1$

3)  $P(\text{something occurs}) = 1$

4)  $P(\text{Nothing occurs}) = 0$

5)  $P(\text{Death}) = 1$

6)  $P(\text{GOD}) = 1$

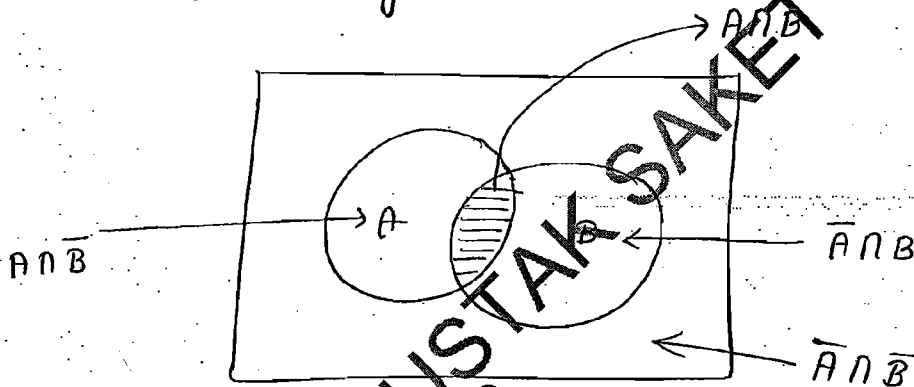
7) In this Chapter we will use following notations:

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

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

ii) Multiplication Theorem  $\Rightarrow$

$$P(A \cap B) = P\left(\frac{A}{B}\right) \cdot P(B)$$
*conditional prob  
this is prob. of A  
when B is already happen.*

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

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

iv) again we can write,

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

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

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

g) Mutually exclusive Events:—

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

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

$$P(A \cup B) = P(A) + P(B) - 0$$

Eg

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

$$\rightarrow B = \{2, 4, 6\}$$

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

Independent Events: If occurrence or non-occurrence of one event does not 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  $P(A \cap B) = P(A) \cdot P(B)$

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

Ques: 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?

$$C = \{H, T\}$$

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

$$E_1 = \{H\}$$

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

$$P(E_1) = \frac{1}{2}$$

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

$$P(E_1 \cap E_2) = \frac{1}{2} \times \frac{2}{3} = \frac{1}{3} \quad \left( \begin{array}{l} \because \text{Dice \& coin are independent} \\ \Rightarrow E_1 \text{ \& } E_2 \text{ are also Independent} \end{array} \right)$$