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Probability :-

Experiment

outcome is certain
↳ deterministic
ex chemical component of ice, steam, water = H_2O

outcome is not certain
↳ probabilistic
ex toss, die, age of dude

0 → Never possible like sun rising from west
1 → always possible sun will rise
0 - 1 → uncertain

→ Basic Terms :-

Random Experiment :- If each trial of an experiment conducted under identical conditions, the outcome is not unique but may be of any possible outcomes.

Outcome :- Results of a random experiment will be called outcome.

Trial and Event :- Any particular ~~experiment~~ performance of a random experiment is called trial and outcomes are termed as event

Exhaustive Event :- Total no of possible outcomes of a random experiment.

Sample Space :- Totality of all possible outcome of an experiment is called sample space.

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6] Mutually Exclusive Events :-
Events are said to be mutually exclusive if the happening of any one of them precludes the happening of all the others i.e no two or more of them can happen simultaneously in the same trial

7] Independent Event :- Happening of one event does not effect the happening of other event

8] Favourable number of cases :- The number of cases favourable to an event in a trial is the number of outcomes which favour the happening of that event

9] Equally Likely Event :- When we have no reason to accept one in preference to other

$P(E) = \frac{\text{favourable no of cases}}{\text{exhaustive no of cases}} = \frac{m}{N}$

$0 \leq m \leq N$ N is finite $0 < P(E) < 1$

Theorems $\Longrightarrow$

1] Additive Law of Probability :-
If A_1 and A_2 are any two sets (subsets of sample space S) and are not mutually exclusive the

$$P(A_1 \cup A_2) = P(A_1) + P(A_2) - P(A_1 \cap A_2)$$

i) If A_1 & A_2 are mutually exclusive then
$P(A_1 \cap A_2) = 0$

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

→ For Independent Events $P(A \cap B) = P(AB) = P(A) P(B)$

→ Conditional Probability - The probability of occurence of an event A_1 when it is known that event A_2 has ~~ability~~ already occured is called conditional probability of A_1 given A_2

$$P(A_1/A_2) = \frac{P(A_1 \cap A_2)}{P(A_2)} ; \quad P(A_2) > 0$$

$$P(A_2/A_1) = \frac{P(A_1 \cap A_2)}{P(A_1)} ; \quad P(A_1) > 0$$

if A_1 & A_2 are independent event then

$$P(A_1/A_2) = \frac{P(A_1 \cap A_2)}{P(A_2)} = \frac{P(A_1)\,\cancel{P(A_2)}}{\cancel{P(A_2)}}$$

$$= P(A_1)$$

Q] A bag contains 9 red balls, 7 white balls and 4 green balls. Three balls are selected randomly. Find the probability of getting one ball of each color and only 2 red balls and 1 from any color.

ans Total no of balls = 20

Exhaustive no. of cases = $^{20}C_3$

(i) Favourable cases = $^9C_1 \times {}^7C_1 \times {}^4C_1$

$$P = \frac{^9C_1 \times {}^7C_1 \times {}^4C_1}{^{20}C_3} = 0.221$$

(ii) Favourable outcomes $= {}^{9}C_2 \times {}^{11}C_1$

$$P = \frac{{}^{9}C_2 \times {}^{11}C_1}{{}^{20}C_3} = 0.347$$

Q] A committee of 4 people is to be appointed from 3 officers of the production department, 4 officers of the purchase department, 2 officers of sales department, 1 CA. Find the probability of forming the committee in the following manner

(i) There must be one from each category

(ii) It should have atleast one from the purchase department.

(iii) The CA must be in the commitee.

Ans Total outcomes $= {}^{10}C_4$

(i) Favourable outcomes $= {}^{3}C_1 \times {}^{4}C_1 \times {}^{2}C_1 \times {}^{1}C_1$

$$P = \frac{{}^{3}C_1 \times {}^{4}C_1 \times {}^{2}C_1 \times {}^{1}C_1}{{}^{10}C_4} = 0.114$$

(ii) Probability $= \frac{{}^{4}C_1 \times {}^{6}C_3}{{}^{10}C_4} + \frac{{}^{4}C_2 \times {}^{6}C_2}{{}^{10}C_4} + \frac{{}^{4}C_3 \times {}^{6}C_1}{{}^{10}C_4} + \frac{{}^{4}C_4 \times {}^{6}C_0}{{}^{10}C_4}$

one method

2nd method $1 - \frac{{}^{6}C_4}{{}^{10}C_4}$