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Presentation on
"Theory of Probability"

Meaning of Probability:

- Chance of occurrence of any event
- In practical life we come across situation where the result are uncertain
- Theory of probability was originated from gambling
- Probability is the branch of Mathematics.
- The 2 broad divisions of probability are

    i) Objective probability

    ii) Subjective probability

Important Terms:

1) Experiment :-

It is the performance or act that produces certain result.

2) Random_Experiment :-

It is the experiments whose results are depend on chance **i.e.** uncertain. **e.g.** Tossing a coin, rolling a dice.

3) Events :-

The results or outcomes of random experiment are known as events.

❑ For Example:

A random experiment :- Flipping a coin twice

Sample space :- S = {(HH), (HT), (TH), (TT)}

The question : “Both the flips show same face

Therefore, the event A : { (HH), (TT) }

Questions for YOU:

Experiment 1:- Flipping a coin thrice

Experiment 2:- Flipping a cube once

Experiment 3:- Flipping a cube twice

Experiment 4:- Playing gambling cards

Types of an Events:

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EVENTS

If the occurrence of one event affects the concurrent of other subsequent event then the events are said to be dependent events

The total number of possible outcomes of a random experiment is called exhaustive events

The event which can't be decomposed into further event.
e.g. tossing coin once

If the occurrence of 1 event implies the non occurrence of other event.
i.e. only 1 event can occur simultaneously, then such events are called mutually exclusive events.
e.g. If a coin is tossed we get 2 mutually exclusive event head and tail

The event that can be decomposed into two or more events.
e.g. getting head when coin tossed twice

If the occurrence of one event does not affect the occurring of another event then the events are said to be independent event.

The complement of an event means non-occurrence of that event.
Denoted by A' OR A^c = S - A

Two or more events are said to equally likely if the chance of their happening is equal.
e.g. P(A)=1/2=P(B)

Classical Definition of Probability :

- Probability of occurrence of the event A is defined as the ratio of the number of events favorable to A to the total numbers of events.
- $P(A) = n(A)/n(S)$

- **Remarks** :-

1) $0 \leq P(A) \leq 1$
2) $P(A) + P(A') = 1$

Statistical Definition :

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- The probability of A is defined as the limiting value of the ratio of F_A to 'n' as 'n' tends to infinity.
- i.e. P(A) = $\lim_{n \to \infty} \frac{F_A}{n}$

Limitations:

- It is applicable only when the total No. of events is finite.
- It can be used only when the events are equally likely.
- This definition is confined to the problems of games of chance

Set Theoretic Approach :

1) $P(A) = \dfrac{n(A)}{n(S)}$

2) If A and B are mutually exclusive then

$$P(A \cap B) = O$$

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

3) If two events A and B are exhaustive then

$$P(A \cup B) = 1$$

4) If A, B and C are equally likely then

$$P(A) = P(B) = P(C)$$

Some Important Theorem:

Theorem 1

- For two mutually exclusive events A and B

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

Theorem 2

- For n mutually exclusive events $A_1, A_2, A_3, ... A_n$

$$P(A_1 \cup A_2 \cup .... \cup A_n) = P(A_1) + ... P(A_n)$$

Theorem 3

- For any two events A and B

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

Theorem 4

- For any three events A, B and C

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

Some Important Theorem:

Theorem 5

- For Dependent Events

$$P\left(\frac{B}{A}\right) = \frac{P(A \cap B)}{P(A)} \quad \&$$

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

Where,

A and B are dependent event.

$P\left(\frac{B}{A}\right)$ read as probability of event B given that the event A has already occurred

Some Important Theorem:

Theorem 6

- For Independent events

1. $P\left(\frac{B}{A}\right) = P(B)$
2. $P(A \cap B) = P(A) \times P(B)$
3. $P(A \cap B \cap C) = P(A) \times P(B) \times P(C)$
4. If A and B are independent then following pairs are also independent.

   A and B'

   A' and B

   A' and B'

ODDs:

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We know that, probability is “the ratio of Favorable outcomes to the total outcome”

i.e. Total Outcomes = Favorable + Unfavorable

Odds In Favor of :

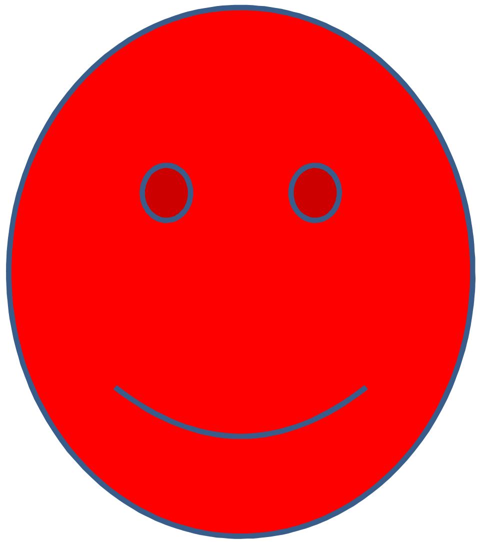
“the ratio of favorable outcome to unfavorable outcome”

Odds Against :

“reciprocal of odds in favor of i.e. unfavorable outcome to the favorable outcome”

Koi Kuch Bolna Chahta hai????

AAAAAbbbbe Samaj lo……



EXAMPLES:

Example Find the probability of getting 3 or 5 in throwing a die.

Solution : Experiment : Throwing a dice

Sample space : S = {1, 2, 3, 4, 5, 6 }   n (S) = 6

Event A : getting 3 or 5

A = {3, 5}   n (A) = 2

Therefore, p (A) = 1/3

Example Two dice are rolled. Find the probability that the score on the second die is greater than the score on the first die.

Solution : Experiment : Two dice are rolled

Sample space : S = {(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), ... (6, 1), (6, 2) (, 3), (6, 4), (6, 5), (6, 6) }

n (S) = 36

Event A : The score on the second die > the score on the 1st die.

i.e. A = { (1, 2), (1, 3), (1, 4), (1, 5), (1, 6) (2, 3), (2, 4), (2, 5), (2, 6), (3, 4), (3, 5), (3, 6) (4, 5), (4, 6) (5, 6)}

n (A) = 15

Therefore, p (A) = 5/12

EXAMPLES:

Example

A ball is drawn at random from a box containing 6 red balls, 4 white balls and 5 blue balls. Determine the probability that the ball drawn is (i) red (ii) white (iii) blue (iv) not red (v) red or white.

Solution : Let R, W and B denote the events of drawing a red ball, a white ball and a blue ball respectively.

$$P(R) = \frac{\text{Number of favorable outcomes}}{\text{Total number of outcomes}} = \frac{n(R)}{n(S)}$$

$$= \frac{6}{6+4+5} = \frac{6}{15} = \frac{2}{5} = 0.4$$

$$\text{(ii)}\ P(W) = \frac{4}{6+4+5} = \frac{4}{15} = 0.26\bar{6}$$

$$\text{(iii)}\ P(B) = \frac{5}{6+4+5} = \frac{5}{15} = \frac{1}{3} = 0.33$$

$$\text{(iv)}\ P(\overline{R}) = 1 - P(R) = 1 - \frac{2}{3} = \frac{3}{5} = 0.6$$

$$\text{(v)}\ P(R+W) = P(R) + P(W) = \frac{2}{5} + \frac{4}{15} = \frac{10}{15} = \frac{2}{3} = 0.6\bar{6}$$

EXAMPLES:

Example What is the chance that a leap year selected at random will contain 53 Sundays ?

Solution : A leap year has 52 weeks and 2 more days.

The two days can be :
Monday - Tuesday
Tuesday - Wednesday
Wednesday - Thursday
Thursday - Friday
Friday - Saturday
Saturday - Sunday and
Sunday - Monday.

There are 7 outcomes and 2 are favorable to the 53rd Sunday.

Now for 53 Sundays in a leap year, P(A)=2/7

EXAMPLES:

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Example In a class there are 13 students. 5 of them are boys and the rest are girls. Find the probability that two students selected at random will be both girls?

Solution : Two students out of 13 can be selected in13C3 ways and two girls out of 8 can be selected in 8C2 ways.

Therefore, required probability P(A)=14/39

Example A box contains 5 white balls, 4 black balls and 3 red balls. Three balls are drawn randomly. What is the probability that they will be (i) white (ii) black (iii) red ?

Solution : Let W, B and R denote the events of drawing three white, three black and three red balls respectively

$$\text{(i) } P(W) = \frac{n(W)}{n(S)} = \frac{^{5}C_3}{^{5+4+3}C_3} = \frac{^{5}C_3}{^{12}C_3} = \frac{1}{22} \text{ or } 0.045$$

$$\text{(ii) } P(B) = \frac{n(B)}{n(S)} = \frac{^{4}C_3}{^{12}C_3} = \frac{1}{55} = 0.018$$

$$\text{(iii) } P(R) = \frac{n(R)}{n(S)} = \frac{^{3}C_3}{^{12}C_3} = \frac{1}{1320} = 0.76 \times 10^{-4}$$

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Thank You.

The Mahesh Wadekar

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