

Topic: Probability

Introduction:

The theory of probability was originated from the games of chance related to gambling. An Italian Mathematician, Jerome Cardan (1501–1576) was the first to write a book named “Book on Games of Chance” published in 1663. Notable contributions were also made by mathematicians J. Bernoulli, P. Laplace and A. A. Markov. In the twentieth century, a book “Foundation of Probability” was published by Russian Mathematician Kolomogorov in 1933 and this was the first book to introduce probability as a set function.

SOME IMPORTANT OBJECTS :

- (i) Coin : Coin is a well- known object. It has two faces, one is Head and other is Tail.
- (ii) Die : A die is a well -balanced solid cube having six faces marked with numbers (dots) from 1 to 6,one number of one face. The plural of die is dice.
- (iii) Playing Cards : A pack of playing cards contains 52 cards out of which 26 are red cards and 26 are black cards.

These 52 cards are divided in four groups, each group is called a suit and has 13 cards. Name of these suits are:

- (i) Diamond (♦)
- (ii) Heart (♥)
- (iii) Spades (♠)
- (iv) Club (♣)

Out of these four suits Diamond and Heart are read cards and Spade and Club are black cards. Each suit having 13 cards which are 1, 2, 3,...., 10, Jack, Queen and King. Card having 1 is also called an ace. Jack, Queen and King are known as face cards. Therefore total 12 face cards are in a pack of 52 playing cards.

Related Topics :

Experiment: An activity which ends in some well defined results is called an experiment. These results are called outcomes. There are two types of experiments:

(i) **Deterministic experiment:**

Those experiments which when repeated under identical conditions produce the same results or outcomes are known as deterministic experiments.

Example: Formation of Methane in laboratory.

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(ii) Random Experiment:

An experiment, when repeated under identical conditions do not produce the same outcome every time but the outcome is one of the several outcomes, it is known as Random Experiment:

Trial:

Performing an experiment once is called a trial.

Sample Space:

The collection of all the possible outcomes of a random experiment is called a sample space. It is usually denoted by S.

Example: After tossing a coin, possible outcomes are head and tail so sample space for tossing a coin consists of head and tail.

Event:

Each possible outcome of a trial is known as an event. It is generally denoted by E. It is of two types:

(i) **Simple Event:** If any event E contains only one outcome of sample space then it is known as simple event. In this way each outcome of sample space related to any experiment is a simple event.

Example: The experiment of throwing a die once consists of 6 simple events viz. coming the face showing up 1 or 2 or 3 or 4 or 5 or 6.

(ii) **Compound Event:** If any event contains more than one outcomes of sample space, then it is known as compound event.

Example: After throwing a die the outcome is an even number i.e. 2 or 4 or 6.

DIFFERENT APPROACHES TO PROBABILITY :

There are following approaches to theory of probability:

- (1) **Empirical Approach**
- (2) **Classical Approach**
- (3) **Axiomatic Approach**

Here we study only Empirical Approach to Probability

What is Probability ?

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Probability is the measure of the likelihood that an event will occur. Probability is quantified as a number between 0 and 1, where, loosely speaking, 0 indicates impossibility and 1 indicates certainty. The higher the probability of an event, the more certain that the event will occur. A simple example is the tossing of a fair (unbiased) coin. Since the coin is fair, the two outcomes ("heads" and "tails") are both equally probable; the probability of "heads" equals the probability of "tails"; and since no other outcomes are possible, the probability of either "heads" or "tails" is $1/2$ (which could also be written as 0.5 or 50%).

Let E be any event related to a Random experiment whose sample space has n outcomes and out of these n outcomes, the event can be performed by m outcomes, then probability of occurrence of event E will be

$$P(E) = \frac{\text{Number of favourable outcomes in sample space for event E}}{\text{Total number of outcomes in sample space}}$$

$$P(E) = \frac{m}{n}; 0 \leq m \leq n$$

Its clear, since $0 \leq m \leq n$, $\Rightarrow 0 \leq \frac{m}{n} \leq 1$, $\Rightarrow 0 \leq P(E) \leq 1$

i.e. probability of any event lies between 0 and 1.

Note:

(i) Probability of any event cannot be less than 0 and cannot be more than 1. So it can be any fraction from 0 to 1.

(ii) If p is the probability of occurrence of an event E and q is the probability of non- occurrence of that event then

$$p + q = 1$$

$$q = 1 - p$$

(iii) The sum of the probabilities of all the possible outcomes of a trial is 1.

IMPOSSIBLE EVENT :

If the number of favorable outcomes for an event is zero then the probability of occurrence of

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that event will be zero and such type of event is known as Impossible Event.

Sure Event or Certain Event

If the number of favorable outcomes for an event is equal to the total number of possible outcomes then the probability of occurrence of that event will be one and such type of event is known as sure or certain event.