Unit No. 13

Probability

Basic Concept

Probaility:

Probability is defined as the chance of occurrence of a particular event. It is calculated using the following formula:

$$\text{Probability} = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}}$$

$$P(A) = \frac{n(A)}{n(S)}$$

Where:

P(A) = Probability of an event A

n(A) = Number of favourable outcomes

n(S) = Total number of possible outcomes

History of Probability (Girolamo Cardano):

The word "probability" is derived from the Latin word "Probabilitas," meaning "probity."

Girolamo Cardano is identified as an Italian doctor and mathematician. He is known for his contributions to the understanding of probability.

Basic Concepts of Probability:

Experiment:

The process which generates results (e.g., tossing a coin, rolling a dice) is called an experiment.

Outcomes:

The results of an experiment. For example, when tossing a coin, the outcomes are head or tail. When rolling a dice, the outcomes are 1, 2, 3, 4, 5, or 6.

Favourable Outcome:

An outcome that represents how many times we expect the desired event to happen. For instance, in a coin toss, getting a head is 1 favorable outcome. When rolling a dice, there are 3 favorable outcomes of getting multiples of 2 i.e. {2, 4, 6}.

Sample Space (S):

The set of all possible outcomes of an experiment.

For a coin toss, S={H,T}.

For a dice roll, S={1,2,3,4,5,6}.

Event (A):

The set of results of an experiment that satisfies a specific condition. For example, rolling a dice and getting an even number is an event A={2,4,6}, and the number of outcomes in this event is n(A)=3.

Types of Events:

Certain event:

An event that is sure to occur. Its probability is 1.

Impossible event:

An event that cannot occur in any trial. Its probability is 0.
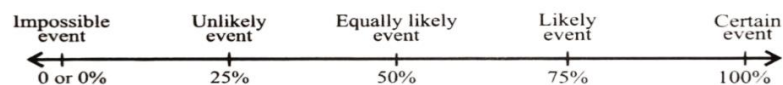
Likely event:

An event that will probably occur. It has a greater chance to occur.

Unlikely event:

An event that will probably not occur. It has less chance to occur.

Equally likely events:

Events that have an equal chance of occurrence. The probability of these events is 0.5.

Remember!

Each element of the sample space is called a sample point.

Keep in mind:

The range of probability for an event is: $0 \leq P(A) \leq 1$.

Remember!

The sum of the probability of an event "A" and the probability of an event not occurring "A' " is always "1"

$P(A)+P(A') = 1$

Relative Frequency as an Estimate of Probability:

Relative frequency tells us how often a specific event occurs relative to the total number of frequency event or trials. It is calculated by using the following method:

Relative frequency $= \frac{\text{Frequency of specific event}}{\text{Total frequency}} = \frac{x}{N}$, where $N = \sum f$

Keep in mind:

The sum of all the relative frequencies is always equal to or approximately equal to 1.

Remember!

Relative frequency is an estimated probability of an event occurring when an experiment is repeated a fixed number of times.

Expected Frequency:

Expected frequency is a measure that estimate how often an event should be occurred depended on probability.

Expected frequency = Total number of trials × Probability of the event.

$$= N \times P(A)$$

Remember!

Sum of all expected frequencies is always equal to or approximately equal to a fixed number of trials.