

PROBABILITY

✓ **Probability formula :** $P(E) = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}}$

✓ **Outcomes space :** A possible result of a random experiment is called its outcome.

✓ **Sample space :** The set of outcomes is called the sample space of the experiment.

✓ **Sample point :** Each element of the sample space is called a sample point.

✓ **Event :** Any subset E of a sample space S is called an event.

✓ **Types of events**

1. **Impossible Events and Sure Events :** The empty set ϕ Impossible Events. The whole sample space S Sure Events

2. **Simple Event :** If any event E has only one sample point of a sample space, it is called a Simple event. (Elementary Event)

3. **Compound Event :** If an event has more than one sample point, it is called a compound event.

✓ **Algebra of events**

1. **Complementary Event of A :** The set A' or $S - A$

2. **The Event ' A ' or ' B ' :** The set $A \cup B$

3. **The Event ' A ' and ' B ' :** The set $A \cap B$

4. **The Event ' A ' but not ' B ' :** The set $A - B$

✓ **Mutually exclusive events :** A and B are mutually exclusive if $A \cap B = \phi$

Note: Simple events of a sample space are always mutually exclusive.

✓ **Exhaustive Events :** If $E_1, E_2, \dots, E_n$ are n events of a sample space S and if

$$E_1 \cup E_2 \cup \dots \cup E_n = \bigcup_{i=1}^n E_i = S \quad \text{then } E_1, E_2, \dots, E_n \text{ are called exhaustive events.}$$

✓ **Probability :** Number $P(\omega_i)$ associated with sample point ω_i such that

$$(i) 0 \leq P(\omega_i) \leq 1 \quad (ii) \sum P(\omega_i) \text{ for all } \omega_i \in S = 1 \quad (iii) P(A) = \sum P(\omega_i) \text{ for all } \omega_i \in A$$

The no. of $P(\omega_i)$ is called probability of the outcome ω_i .

✓ **Equally likely outcomes :** All outcomes with equal probability

✓ **Probability of an event :** For a finite sample space with equally likely outcomes.

$$P(A) = \frac{n(A)}{n(S)} \quad \begin{array}{l} \text{number of elements in the set } A \\ \text{number of elements in the set } S \end{array}$$

✓ If A and B are any two events, then $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

✓ If A and B are mutually exclusive, then $P(A \cup B) = P(A) + P(B)$

✓ If A is any event then $P(\text{not } A) = 1 - P(A)$

✓ **Conditional Probability :** If E and F are two events with the same space of a random experiment, then the conditional Probability of the event E gives that F has occurred i.e.

$$P\left(\frac{E}{F}\right) = \frac{P(E \cap F)}{P(F)}, \text{ provided } P(F) \neq 0$$

✓ **Probability of Conditional Probability**

$$1. P\left(\frac{S}{F}\right) = P\left(\frac{F}{F}\right) = 1$$

$$3. P\left(\frac{E'}{F}\right) = 1 - P\left(\frac{E}{F}\right)$$

2. If A and B are two events in a sample space S and F is an event of S , such that $P(F) \neq 0$ then;

$$P\left(\frac{A \cup B}{F}\right) = P\left(\frac{A}{F}\right) + P\left(\frac{B}{F}\right) - P\left(\frac{A \cap B}{F}\right)$$