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Probability Formula

The probability formula is defined as the likelihood of an event to happen. It is equal to the ratio of the number of favourable results and the total number of outcomes. The formula for the probability of an event to occur is given by;

P(E) = Number of favourable outcomes/Total Number of outcomes

Conditional Probability

Conditional Probability is the likelihood of an event or outcome occurring based on the occurrence of a previous event or outcome. It simply depends on any event in the past which has already taken place.

If E and F are two events with the same sample space of a random experiment, then the conditional probability of the event E gives that F has occurred, i.e. $P(E|F)$ is,

$P(E|F) = P(E \cap F)/P(F)$, provided $P(F) \neq 0$

Properties of Conditional Probability

Let E and F be events of a sample space S of an experiment, then;

Property 1: $P(S|F) = P(F|F) = 1$

Property 2: If A and B are two events in a sample space S and F is an event of S, such that $P(F)\neq0$, then;

$P((A \cup B)|F) = P(A|F) + P(B|F) - P((A \cap B)|F)$

Property 3: $P(E'|F) = 1 - P(E|F)$

Multiplication Rule

Let E and F be two events associated with a sample space S. Clearly, the set $E \cap F$ denotes the event that both E and F have occurred. In other words, $E \cap F$ denotes the simultaneous occurrence of the events E and F. The event $E \cap F$ is also written as EF. According to this rule, if E and F are the events in a sample space, then;

$P(E \cap F) = P(E)\, P(F|E) = P(F)\, P(E|F)$

where $P(E) \neq 0$ and $P(F) \neq 0$

Multiplication Theorem on Probability

$P(E \cap F) = P(E)\, P(F|E) = P(F)\, P(E|F)$ provided $P(E) \neq 0$ and $P(F) \neq 0$

Multiplication rule of probability for more than two events

$P(E \cap F \cap G) = P(E)\, P(F|E)\, P(G|(E \cap F)) = P(E)\, P(F|E)\, P(G|EF)$

Similarly, the multiplication rule of probability can be extended for four or more events.

Independent Events

Two experiments are said to be independent if for every pair of events E and F, where E is associated with the first experiment and F with the second experiment, the probability of the simultaneous occurrence of the events E and F when the two experiments are performed is the product of P(E) and P(F) calculated separately on the basis of two experiments, i.e.,

$P(E \cap F) = P(E).P(F)$