Probability

Introduction to Probability

Probability

The branch of mathematics that measures the uncertainty of the occurrence of an event using numbers is called probability. The chance that an event will or will not occur is expressed on a scale ranging from 0-1.

It can also be represented as a percentage, where 0% denotes an impossible event and 100 % implies a certain event.

Event and outcome

An **Outcome** is a result of a random experiment. For example, when we roll a dice getting six is an outcome.
An **Event** is a set of outcomes. For example when we roll a dice the probability of getting a number less than five is an event.
Note:
An Event can have a single outcome.

Experimental Probability

Experimental Probability

Experimental probability can be applied to any event associated with an experiment that is repeated a large number of times.
A trial is when the experiment is performed once. It is also known as **empirical probability**.
Experimental or empirical probability: P(E) = $\frac{Number\ of\ trials\ where\ the\ event\ occurred}{Total\ number\ of\ trials}$

Theoretical Probability

Theoretical Probability

Theoretical Probability
$P(E) = \frac{Number\ of\ outcomes\ favourable\ to\ E}{Number\ of\ all\ possible\ outcomes\ of\ the\ experiment}$
Here we assume that the outcomes of the experiment are **equally likely**.

Elementary Event

An event having only **one outcome** of the experiment is called an **elementary event**.
Example: Take the experiment of tossing a coin n number of times. One trial of this experiment has two possible outcomes: Heads(H) or Tails(T). So for an individual toss, it has only one outcome, i.e Heads or Tails.

Sum of Probabilities

The **sum** of the probabilities of all the **elementary events** of an experiment is **one**.
Example : take the coin tossing experiment. P(Heads) + P(Tails) $= \frac{1}{2} + \frac{1}{2} = 1$.

Impossible event

An event that has **no chance of occurring** is called an **Impossible event**, i.e. P(E) = 0.
E.g: Probability of getting a 7 on a roll of a die is 0. As 7 can never be an outcome of this trial.

Sure event

An event that has a **100% probability** of occurrence is called a **sure event**. The probability of occurrence of a **sure event** is **one**.
E.g: What is the probability that a number obtained after throwing a die is less than 7?
So, P(E) = P(Getting a number less than 7) $= \frac{6}{6} = 1$

Range of Probability of an event

The range of probability of an event lies between 0 and 1 inclusive of 0 and 1, i.e.
$0 \leq P(E) \leq 1$.

Geometric Probability

Geometrical Probability

Geometric probability is the calculation of the likelihood that one will hit a particular area of a figure. It is calculated by dividing the desired area by the total area. In case of Geometrical probability, there are infinite outcomes.

Complementary Events

Complementary event

Complementary events are two outcomes of an event that are the only two possible outcomes. This is like flipping a coin and getting heads or tails. $P(E) + P(\overline{E}) = 1$, where E and $\overline{E}$ are the complementary events.
The event $\overline{E}$, representing '**not E**', is called the **complement** of the event **E**.