Board –CBSE | Class –10th | Topic – Probability

In the experimental approach to probability, we find the probability of the occurrence of an event by actually experimenting several times and adequate recording of the happening of the event.

In the theoretical approach to probability, we try to predict what will happen without actually performing the experiment.

An outcome of a random experiment is called an elementary event.
For Example: Consider the random experiment of tossing coins. The possible outcome of this experiment is head (H) and tail (T). If we define E_1 = getting head (H), E_2 = getting tail (T) then, E_1 and E_2 are elementarily associated with the experiments of tossing of a coin.

An event associated with a random experiment is a compound event if it is obtained by combining two or more elementary events associated with the random experiment.
For Example: In a single throw of a die, the event "getting an even number" is a compound event as it is obtained by combining three elementary events, namely 2, 4, 6.

An event A associated with a random experiment is said to occur if any one of the elementary events associated with event A is an outcome.
For Example: Consider the random experiment of throwing an unbiased die. Let A denote the event "getting an even number". Elementary events associated with this event are 2, 4, 6. Now, suppose that in a trial the outcome is 4, and then we say that event A has occurred. In another trial, let the outcome be 3, then we say that event A has not occurred.

An elementary event is said to be favorable to compound event A, if it satisfies the definition of the compound event.
For Example: Consider the random experiment of two coins being tossed simultaneously and A is an event associated with it is defined as "getting exactly one head". We say that

event A occurs if we get either HT or TH as an outcome. So, there are two elementary events favorable to event A.

If there are n elementary events associated with a random experiment and m of them are favorable to an event A, then the probability of happening occurrence of event A is denoted by $P(A)$ and is defined as the ratio m : n i.e. $P(A) = \frac{m}{n}$

For Example: Let A denote the event of "getting an even number".

Clearly, event A occurs if we obtain any one of 2, 4, 6 as an outcome.

Favorable number of elementary events $= 3$

$P(A) = \frac{3}{6} = \frac{1}{2}$

For any event A associated with a random experiment, we have

(i) $0 \leq P(A) \leq 1$

(ii) $\overline{P(A)} = 1 - P(A)$

Proof of (i):

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

$0 \leq m < n$

$0 \leq mn \leq 1$

$0 \leq P(A) \leq 1$

Proof of (ii):

If $P(A) = 1$, then A is called a certain event and A is called an impossible event, if $P(A) = 0$.

If m elementary events are favorable to an event A out of n elementary events, then the number of elementary events which ensure the non-occurrence of A, i.e. the occurrence of A^{-} is $n - m$

$P(\bar{A}) = \frac{n-m}{n}$

$P(\bar{A}) = 1 - \frac{m}{n}$

$P(A) = 1 - P(A)$

The probability of a sure event is 1.

Example: The sun is rising from the east. This is a sure event. so the probability of a sure event is 1.

The probability of an impossible event is 0.

Example: Suppose the sun is rising from the west. This event is impossible so the probability of an impossible event is always 0.

The sum of the probabilities of all the outcomes (elementary events) of an experiment is 1.

For Example: Suppose in an experiment of tossing a coin 10 times, 6 times heads appear and 4 times tails appear.

So the probability of getting head is $P(H) = \frac{m}{n}$

where m is the number of times head appears and n is the number of times of tossing coins.

So, $P(H) = \frac{6}{10} = 0.6$

Now the probability of getting tail is given by $P(T) = \frac{m}{n}$

where m is the number of time the tail appear and n is the number of times you toss coins.

So, $P(T) = \frac{4}{10} = 0.4$

So the total probability of this experiment is given by

$P(A) = P(H) + P(T) \cdot P(A) = 0.6 + 0.4 \, P(A) = 1$

Hence the sum of the probability of all outcomes of an experiment is always 1.