Class XI: Math
Chapter: Probability
Chapter Notes

Key Concepts

1. The theory of probability is a branch of mathematics that deals with uncertain or unpredictable events. Probability is a concept that gives a numerical measurement for the likelihood of occurrence of an event.

2. An act which gives some result is an experiment.

3. A possible result of an experiment is called its outcome.

4. The sample space S of an experiment is the set of all its outcomes. Thus, each outcome is also called a sample point of the experiment

5. An experiment repeated under essentially homogeneous and similar conditions may result in an outcome, which is either unique or not unique but one of the several possible outcomes.

6. An experiment is called random experiment if it satisfies the following two conditions:
   (i) It has more than one possible outcome.
   (ii) It is not possible to predict the outcome in advance.

7. The experiment that results in a unique outcome is called a deterministic experiment.

8. Sample space is a set consisting of all the outcomes, its cardinality is given by n(S).
9. Any subset '*E*' of a sample space for an experiment is called an **event.**

10. The empty set ϕ and the sample space S describe events. In fact ϕ is called an impossible event and S, i.e., the whole sample space is called the sure event.

11. Whenever an outcome satisfies the conditions, given in the event, we say that the **event has occurred**

12. If an event E has only one sample point of a sample space, it is called a simple (or elementary) event. In the experiment of tossing a coin, the sample space is {H,T}and the event of getting a {H} or a {T}is a simple event.

13. A subset of the sample space, which has more than on element is called a compound event. In throwing a dice, the event of appearing of odd numbers is a compound event, because E={1,3,5} has '3' sample points or elements in it.

14. Events are said to be equally likely, if we have no reason to believe that one is more likely to occur than the other. The outcomes of an unbiased coin are equally likely.

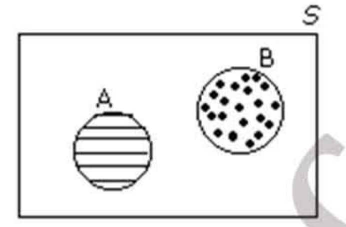
15. Probability of an event E, is the ratio of happening of the number of element in the event to the number of elements in the sample space.

(i) $P(E) = \frac{n(E)}{n(S)}$ (ii) $0 \leq P(E) \leq 1$

16. Independent Events: Two or more events are said to be independent if occurrence or non-occurrence of any of them does not affect the probability of occurrence or non-occurrence of the other event.

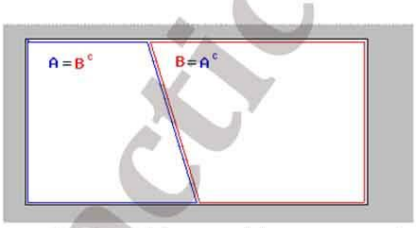
17. The complement of an event A, is the set of all outcomes which are not in A (or not favourable to) A. It is denoted by A'.

18. Events Aand B are said to be mutually exclusive **if and only if** they have no elements in common.



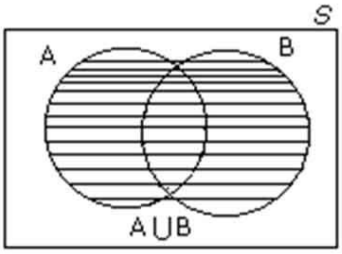
Mutually exclusive events

19. When every possible outcome of an experiment is considered, the events are called exhaustive events.

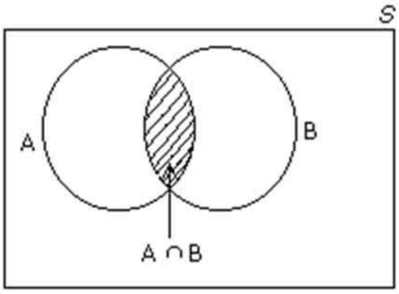


Events $E_1, E_2, \ldots, E_n$ are mutually exclusive and exhaustive if $E_1 \cup E_2 \cup \ldots \cup E_n = S$ and $E_i \cap E_j = \varphi$, for every distinct pair of events.

20. When the sets A and B are two events associated with a sample space, then '$A \cup B$' is the event 'either A or B or both.
Therefore Event ' A or B' = $A \cup B$ = $\{\omega : \omega \in A \text{ or } \omega \in B\}$

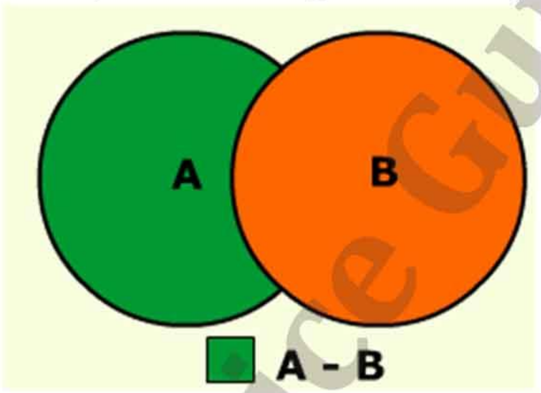


21.If A and B are events, then the event **'A and B'** is defined as the set of all the outcomes which are favourable to both A and B, i.e. 'A and B' is the event $A \cap B$. This is represented diagrammatically as follows



22. If A and B are events, then the event **'A - B'** is defined to be the set of all outcomes which are favourable to a but not to B. $A - B = = A \cap B' = \{ x : x \in A \text{ and } x \notin B\}$

This is represented diagrammatically as:



23. If S is the sample space of an experiment with n equally likely outcomes $S= \{w_1, w_2, w_3, ----w_n\}$ then $P(w_1) = P(w_2) = P(w_n) = n$

$$\sum_{i=1}^{n} P(w_i) = 1$$

So $P(w_n) = 1/n$

24. Let S be the sample space of a random experiment. The probability P is a real valued function with domain the power set of S and range the interval [0,1] satisfying the axioms that

(i) For any event E, P (E) is greater than or equal to 1.

(ii) P (S) = 1

(iii) Number P (ωi) associated with sample point ω_i such that

$$0 \le P(\omega_i) \le 1$$

25. Addition Theorem of probability If 'A' and 'B' be any two events, then the probability of occurrence of at least one of the events 'A' and 'B' is given by:

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

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

26. **Addition Theorem for 3 events**

$P(AUBUC) = P(A)+P(B)+P(C)-P(A \cap B)-P(B \cap C)-P(A \cap C)+P(A \cap B \cap C)$

27. If 'E' is any event and E' be the complement of event 'E', then
$P(E') = 1 - P(E)$

28. Probability of difference of events: Let A and B be events.
Then, $P(A - B) = P(A) - P(A \cap B)$

29. Addition theorem in terms of difference of events:
$P(A \cup B) = P(A-B)+P(B-A)+ P(A \cap B)$