Class XI: Math

Chapter 7: permutation and Combination

Chapter Notes

Key Concepts

1. Fundamental principle of counting: These are two fundamental principles of counting as follows:

1) Multiplication Principle
2) Addition Principle

2.**Multiplication Principle:** If an event can occur in **M** different ways, following which another event can occur in **N** different ways, then the total number of occurrence of the events in the given order is **M x N**. This principle can be extended to any number of finite events. Keyword here is "And"

3**. Addition Principle:** If there are two jobs such that they can be performed independently in **M** and **N** ways respectively, then either of the two jobs can be performed in (**M** + **N**) ways. This principle can be extended to any number of finite events. Keyword here is "OR"

4. The notation n! represents the product of first n natural numbers. n!=1.2.3.4…….n

5. A permutation is an arrangement in a definite order of a number of objects taken some or all at a time. In permutations order is important.

6. The number of permutation of n different objects taken r at a time, where $0< r \leq n$ and the objects do not repeat is $n(n-1)(n-2)\ldots(n-r+1)$ which is denoted by ${}^{n}P_{r}$

7. The number of permutation of n different objects taken r at a time, where repetition is allowed is n^{r}.

8. The number of permutation of n objects, where p, objects are of one kind and rest are all different is given by $\frac{n!}{p!}$.

9.The number of permutation of n objects, where p_1, objects are of one kind, p_2, are of second kind, … p_k, are of k^{th} kind and the rest, if any are of different kind is $\frac{n!}{p_1!p_2!\ldots p_k!}$.

10. Keyword of permutations is "arrangement"

11. The number of combinations or selection of r different objects out of *n* given different objects is ${}^nC_r$ which is given by

$${}^nC_r = \frac{n!}{r!(n-r)!} \quad 0 \le r \le n$$

12 Number of combinations of n different things taken nothing at all is considered to be 1

13. Counting combinations is merely counting the number of ways in which some or all objects at a time are selected.

14. Keyword of combinations is "selection".

15. Selecting r objects out of n objects is same as rejecting (n – r) objects so ${}^nC_{n-r} = {}^nC_r$

16.Order is not important in combinations.

Key Formulae

1. n! = 1 x 2 x 3 x …x n or n! = n x (n -1)!
2. n!=n(n-1)(n-2)!(provided n≥2)
3. n!=n n(n-1)(n-2)(n-3)! (provided n≥3)
4. 0!=1!=1
5. ${}^nP_r = \frac{n!}{(n-r)!}, \quad 0 \le r \le n$
6. ${}^nP_n = \frac{n!}{(n-n)!} = \frac{n!}{0!} = n!$
7. ${}^nP_0 = \frac{n!}{(n-0)!} = \frac{n!}{n!} = 1$

8. ${}^{n}C_{r} = \frac{n!}{r!(n-r)!}\ 0 \le r \le n$

9. ${}^{n}P_{r} = {}^{n}C_{r} \times r!,\ 0 < r \le n$

10. ${}^{n}C_{0} = 1$

11. ${}^{n}C_{0} = {}^{n}C_{n} = 1$

12. ${}^{n}C_{n} = {}^{n}C_{1} = n$

13. ${}^{n}C_{n-r} = \frac{n!}{(n-r)!(n-(n-r))!} = \frac{n!}{(n-r)!r!} = {}^{n}C_{r}$

14. ${}^{n}C_{a} = {}^{n}C_{b} \Rightarrow a = b$