**Permutation and Combination.**

**important formulas**

1. **Factorial Notation:**

Let *n* be a positive integer. Then, factorial *n*, denoted *n*! is defined as:

**n! = n(n - 1)(n - 2) ... 3.2.1.**

**Examples:**

* 1. We define **0! = 1**.
  2. 4! = (4 x 3 x 2 x 1) = 24.
  3. 5! = (5 x 4 x 3 x 2 x 1) = 120.

1. **Permutations:**

The different arrangements of a given number of things by taking some or all at a time, are called permutations.

**Examples:**

* 1. All permutations (or arrangements) made with the letters *a*, *b*, *c* by taking two at a time are (***ab*, *ba*, *ac*, *ca*, *bc*, *cb***).
  2. All permutations made with the letters *a*, *b*, *c* taking all at a time are:  
     (***abc*, *acb*, *bac*, *bca*, *cab*, *cba***)

1. **Number of Permutations:**

Number of all permutations of *n* things, taken *r* at a time, is given by:

|  |  |
| --- | --- |
| nPr = *n*(*n* - 1)(*n* - 2) ... (*n* - *r* + 1) = | *n*! |
| (*n* - *r*)! |

**Examples:**

* 1. 6P2 = (6 x 5) = 30.
  2. 7P3 = (7 x 6 x 5) = 210.
  3. **Cor. number of all permutations of *n* things, taken all at a time = *n*!.**

1. **An Important Result:**

If there are *n* subjects of which *p*1 are alike of one kind; *p*2 are alike of another kind; *p*3 are alike of third kind and so on and *p*r are alike of *r*th kind,   
such that (*p*1 + *p*2 + ... *p*r) = *n*.

|  |  |
| --- | --- |
| Then, number of permutations of these *n* objects is = | *n*! |
| (*p*1!).(*p*2)!.....(*p*r!) |

1. **Combinations:**

Each of the different groups or selections which can be formed by taking some or all of a number of objects is called a **combination**.

**Examples:**

* 1. Suppose we want to select two out of three boys A, B, C. Then, possible selections are AB, BC and CA.

Note: AB and BA represent the same selection.

* 1. All the combinations formed by *a*, *b*, *c* taking ***ab*, *bc*, *ca***.
  2. The only combination that can be formed of three letters *a*, *b*, *c* taken all at a time is ***abc***.
  3. Various groups of 2 out of four persons A, B, C, D are:

**AB, AC, AD, BC, BD, CD**.

* 1. Note that *ab* *ba* are two different permutations but they represent the same combination.

1. **Number of Combinations:**

The number of all combinations of *n* things, taken *r* at a time is:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| nCr = | *n*! | = | *n*(*n* - 1)(*n* - 2) ... to *r* factors | . |
| (*r*!)(*n* - *r*)! | *r*! |