

Permutation:

A Permutation is a collection or a combination of objects from a set where the order or the arrangement of the chosen objects does matter. In other words, a Permutation is an arrangement of objects in a definite order, For example, if we have two elements A and B, then there are two possible arrangements, (A B) and (B A).

Formulas for Permutations:

$$nPr = n(n-1)(n-2)$$

$$nPr = 1$$

$$nPr = n$$

$$nPr = n!$$

$$nPr = n \cdot n-1Pr-1 = n(n-1)n-2Pr-2$$

The number of permutations when 'r' elements are arranged out of a total of 'n' elements is $nPr = n! / (n-r)!$

For example, let $n = 4$ (A, B, C and D) and $r = 2$ (All permutations of size 2). The answer is $4!/(4-2)! = 12$. The twelve permutations are AB, AC, AD, BA, BC, BD, CA, CB, CD, DA, DB, and DC.

A Combination is the different selections of a given number of elements taken one by one, or some, or all at a time. For example, if we have two elements A and B, then there is only one way to select two items, we select both of them.

Formulas for Combinations:

nCr is a natural number

$$nCr = (nCn) = 1$$

$$nCr = n$$

$$nCr = (nCn-r)$$

$$nC_x = nC_y \Rightarrow x=y \text{ or } x+y=n$$

$$n \cdot n-1Cr-1 = (n-r+1) \times nCr-1$$

The number of combinations when 'r' elements are selected out of a total of 'n' elements is $nCr = n! / ((r!) \times (n-r)!)$.

For example, let $n = 4$ (A, B, C and D) and $r = 2$ (All combinations of size 2). The answer is $4!/((4-2)!*2!) = 6$. The six combinations are AB, AC, AD, BC, BD, and CD.

Note: In the same example, we have different cases for permutation and combination. For permutation, AB and BA are two different things but for selection, AB and BA are the same.