Let's generalize it. Permutations of choosing R disticnt objects out of a collection of N objects can be calculated using the following formula:

NpR=N!/(N−R)!

Combinations of choosing R distinct objects out of a collection of N objects can be calculated using the following formula:

NcR=N!/(N−R)!×R!

## ****Basic Combinatorics Rules:****

Suppose there are two sets A and B.

The basic rules of combinatorics one must remember are:

1. **The Rule of Product**:   
   The product rule states that if there are X number of ways to choose one element from A and Y number of ways to choose one element from B, then there will be X×Y number of ways to choose two elements, one from A and one from B.
2. **The Rule of Sum**:   
   The sum rule states that if there are X number of ways to choose one element from A and Y number of ways to choose one element from B, then there will be X+Y number of ways to choose one element that can belong to either A or to B.

These rules can be used for a finite collections of sets.

**Permutations with repetition:**

If we have N objects out of which N1 objects are of type 1, N2 objects are of type 2, ... Nk objects are of type k, then number of ways of arrangement of these N objects are given by:

N!/N1!N2!...Nk!

**Combinations with repetition**:

If we have N elements out of which we want to choose K elements and it is allowed to choose one element more than once, then number of ways are given by:

N+K−1CK=(N+K−1)/!(K)!(N−1)!

Now let's try to solve the problem given below.  
Given N and K find out how many different ways are there to represent N as sum of K non-zero integers.  
Let's take an example. Sum of elements of following sets, which are of size 3, is equal to 5:  
{1,1,3}  
{1,3,1}  
{3,1,1}  
{2,2,1}  
{2,1,2}  
{1,2,2}

We can rewrite the above sets as follows:  
{1,1,1+1+1}  
{1,1+1+1,1}  
{1+1+1,1,1}  
{1+1,1+1,1}  
{1+1,1,1+1}  
{1,1+1,1+1}

So, clearly there are exactly five 1′s, and between those there is either a comma or a plus sign, and also comma appears exactly 2 times.   
{1−1−1−1−1}   
Clearly there are 4 dashes and we have to choose 2 out of those and place a comma there, and at the rest place plus sign. So, number of way of choosing 2 objects out of 4 is 4C2=6.  
In general, for N there will be N−1 dashes, and out of those we want to choose K−1 and place comma in place of those and in place of rest of the dashes place plus sign. So ways of choosing K−1 objects out of N−1is N−1CK−1

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