

Combination and permutation

Combination: A combination, refers to the selection of objects without regard to the order in which they were selected. It answers the question, "In how many ways can you select 'k' objects from a set of 'n' distinct objects, where order doesn't matter?"

Formula for Combinations (nCr):

$$nCr = n! / (r! * (n - r)!)$$

- n represents the total number of items.
- r is the number of items to be chosen.
- $n!$ is the product of all positive integers from 1 to n .
- $r!$ is the product of all positive integers from 1 to r .
- $(n - r)!$ $((n - r)!)$ is the product of all positive integers from 1 to $(n - r)$.

Examples:

Here's an example: If you have a deck of 52 playing cards and want to choose 5 cards (without considering the order), it's denoted as "52 choose 5" or $52C5$. Using the formula:

$$52C5 = 52! / (5! * (52 - 5)!)$$

After calculations, you'll find $52C5$ equals 2,598,960, meaning there are 2,598,960 different ways to choose 5 cards from a deck of 52.

Permutation: A permutation refers to an arrangement of objects in a specific order. It answers the question, "In how many ways can you arrange 'n' distinct objects?" Permutations take into account the order in which objects are arranged, meaning that changing the order of the objects results in a different permutation.

The formula for calculating permutations is often denoted as " nPr ," where " n " represents the total number of items, and " r " represents the number of items to be arranged.

The formula is: $nPr = n! / (n - r)!$

Where: n is the total number of items.

r is the number of items to be arranged.

$n!$ is the product of all positive integers from 1 to n .

$(n - r)!$ is the product of all positive integers from 1 to $(n - r)$.

Here's an example:

If you want to arrange 5 cards from a deck of 52 playing cards in a specific order based on their ranks, you're essentially creating permutations based on card ranks.

For example, you could arrange 5 cards in ascending order of rank. This means that you're considering the order of the ranks, and each arrangement would be a different permutation. Here's how you can calculate the number of permutations:

In the scenario of arranging 5 cards in ascending order of rank from a deck of 52 playing cards:

- n (total number of cards to choose from) = 52
- r (number of cards to arrange in a specific order) = 5

Using the permutations formula:

$$nPr = n! / (n - r)!$$

$n!$ is the product of all positive integers from 1 to n . $(n - r)!$ is the product of all positive integers from 1 to $(n - r)$.

Let's calculate it:

$$nPr = 52! / (52 - 5)! \quad nPr = 52! / 47!$$

Now, you can calculate this using the factorial values, or you can use a calculator that supports factorial calculations to determine the number of permutations.

This formula calculates the number of permutations when you arrange 5 cards in ascending order of rank from a deck of 52 playing cards.

Note : We will study more about them in depth later on as the course progresses.