

Chapter 4 - Permutations and Combinations

In mathematics, combination and permutation are two different ways of grouping elements of a set into subsets.

Permutation cares about the order

The combination doesn't care about the order

Permutation and combination are the ways to select certain objects from a group of objects to form subsets with or without replacement.

In mathematics, permutation relates to the act of arranging all the members of a set into some sequence or order

The combination is a way of selecting items from a collection, such that (unlike permutations) the order of selection does not matter.

Permutation formula:

$$nPr = \frac{n!}{(n-r)!}$$

Combination formula:

$${}^nC_r = \binom{n}{r} = \frac{{}^nP_r}{r!} = \frac{n!}{r!(n-r)!}$$

Permutation	Combination
Arranging people, digits, numbers, alphabets, letters, and colors	Selection of menu, food, clothes, subjects, and team.
Picking a team captain, pitcher, and shortstop from a group.	Picking three team members from a group.
Picking two favourite colours, in order, from a colour brochure.	Picking two colours from a colour brochure.
Picking first, second, and third place winners.	Picking three winners.

Example:

How many numbers of four digits can be formed with the digits 1,2,3,4 and 5? (repetition of digits is not allowed)

$$\text{Required number: } {}^5P_4 = \frac{5!}{1!} = 5 \times 4 \times 3 \times 2 = 120$$

Combinations:



Selecting 4 fruits out of 10 fruits

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

$$\begin{aligned} {}^{10}C_4 &= C(n, r) = C(10, 4) \\ &= \frac{10!}{(4!(10-4)!)} \\ &= \frac{10!}{4! \times 6!} \\ &= 210 \text{ ways} \end{aligned}$$