Combinations and Permutations

The factorial function

The factorial function (symbol: !) just means to multiply a series of descending natural numbers. Examples:

- $4! = 4 \times 3 \times 2 \times 1 = 24$
- $7! = 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 5,040$
- $1! = 1$
- $0! = 1$

Importantly

$$n! = n \times (n-1)! = n \times (n-1) \times (n-2)!$$

For Example

$$6! = 6 \times 5! = 6 \times 5 \times 4!$$

Combinations

In mathematical terms, a combination is an subset of items from a larger set such that the order of the items does not matter.

Permutations

There are two types of permutation:

1. Repetition is Allowed: such as the lock above. It could be "333".
2. No Repetition: for example the first three people in a running race. You can't be first and second.

Summary

- If the order doesn't matter, it is a Combination.
- If the order does matter it is a Permutation.