Reference: <https://betterexplained.com/articles/easy-permutations-and-combinations/>

**Examples** of combinations (picking order doesn’t matter) from permutations (picking order matters)

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**Permutations: Order matters**

**Permutations with Repetition**

Example: in the lock, there are 10 numbers to choose from (0,1,2,3,4,5,6,7,8,9) and we choose 3 of them:

* 10 × 10 × ... (3 times) = 103 = 1,000 permutations

**Permutations without Repetition**

Let’s start with permutations, or **all possible ways** of doing something. We’re using the fancy-pants term “permutation”, so we’re going to care about every last detail, including the order of each item. Let’s say we have 8 people:

1: Alice

2: Bob

3: Charlie

4: David

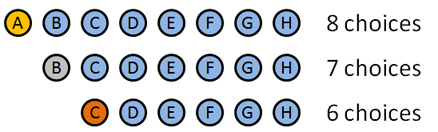
5: Eve

6: Frank

7: George

8: Horatio

How many ways can we award a 1st, 2nd and 3rd place prize among eight contestants? (Gold / Silver / Bronze)



* Gold medal: 8 choices: A B C D E F G H (Clever how I made the names match up with letters, eh?). Let’s say A wins the Gold.
* Silver medal: 7 choices: B C D E F G H. Let’s say B wins the silver.
* Bronze medal: 6 choices: C D E F G H. Let’s say… C wins the bronze.

The total number of options was 8∗7∗6=336

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## Combinations: Order doesn’t matter

Combinations are easy going. Order doesn’t matter.

**Combinatiions without Repetition**

If we don’t want to separate Gold, Silver and Bronze medals. In fact, I can only afford tin cans.

How many ways can I give 3 tin cans to 8 people?

This raises an interesting point - we’ve got some redundancies here.

Alice Bob Charlie = Charlie Bob Alice.

For a moment, let’s just figure out how many ways we can rearrange 3 people.

We have 3 choices for the first person, 2 for the second, and only 1 for the last. So we have 3∗2∗1 = 3! = 6 ways to re-arrange 3 people.

If we want to figure out how many combinations we have, we just **create all the permutations and divide by all the redundancies**. In our case, we get 336 permutations (from above), and we divide by the 6 redundancies for each permutation and get 336/6 = 56.

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“c choose k”

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