COMBINATIONS

For combinations, ***k* objects are selected from a set of *n* objects to produce subsets without ordering.**

Contrasting the previous permutation example with the corresponding combination,the AB and BA subsets are no longer distinct selections;

by eliminating such cases there remain only 10 different possible subsets—AB, AC, AD, AE, BC, BD, BE, CD, CE, and DE.

The number of such subsets is denoted by $_nC_k$, read **"*n* choose *k*."** For combinations, since ***k* objects have *k*! arrangements**, there are *k*! indistinguishable permutations for each choice of *k* objects;

hence dividing the permutation formula by *k*! yields the following combination formula:

$$_nC_k = \frac{n!}{k!\,(n-k)!}.$$

This is the same as the (*n*, *k*) binomial coefficient (*see* **binomial theorem**). For example, the number of combinations of five objects taken two at a time is

$$_5C_2 = \frac{5!}{(2)!\,(5-2)!} = \frac{5!}{(2)!\,(3)!} = \frac{(1)(2)(3)(4)(5)}{(1)(2)(1)(2)(3)} = \frac{120}{12} = 10.$$

The formulas for $_nP_k$ and $_nC_k$ are called counting formulas

since they can be used to count the number of possible permutations or combinations in a given situation **<u>without having to list them</u>**

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