Permutation

A selection of objects in which the order of the objects matters.

Example: The permutations of the letters in the set {a, b, c} are:

abc	acb
bac	bca
cab	cba

Permutation Formula

A formula for the number of possible permutations of *k* objects from a set of *n*. This is usually written ${}_{n}P_{k}$.

Formula: $${}_{n}\mathrm{P}_{k} = \frac{n!}{(n-k)!} = n\,(n-1)\,(n-2)\cdots(n-k+1)$$

Example: How many ways can 4 students from a group of 15 be lined up for a photograph?

Answer: There are ${}_{15}P_{4}$ possible permutations of 4 students from a group of 15.

$${}_{15}\mathrm{P}_{4} = \frac{15!}{11!} = 15 \cdot 14 \cdot 13 \cdot 12 = 32760 \text{ different lineups}$$

Combination

A selection of objects from a collection. Order is irrelevant.

Example: A poker hand is a combination of 5 cards from a 52 card deck. This is a combination since the order of the 5 cards does not matter.

Combination Formula

A formula for the number of possible combinations of *r* objects from a set of *n* objects. This is written in any of the ways shown below.

$$\binom{n}{r} \text{ or } {}_nC_r \text{ or } C(n,r) \text{ or occasionally } \mathrm{C}_r^n$$

All forms are read aloud "*n* choose *r*."

Formula: $$\binom{n}{r} \text{ or } {}_nC_r = \frac{n!}{r!\,(n-r)!} = \frac{n\,(n-1)\,(n-2)\cdots(n-r+1)}{r!}$$

Note: $\binom{n}{r} = \frac{{}_nP_r}{r!}$, where ${}_nP_r$ is the formula for permutations of *n* objects taken *r* at a time.

Example: How many different committees of 4 students can be chosen from a group of 15?

Answer: There are $\binom{15}{4}$ possible combinations of 4 students from a set of 15.

$$\binom{15}{4} = \frac{15!}{4!11!} = \frac{15\cdot 14\cdot 13\cdot 12}{4\cdot 3\cdot 2\cdot 1} = 1365$$

There are 1365 different committees.