Determining the Number of Possible Combinations (Order does not matter)

When counting with ***Permutations***, the order the objects are chosen is important. When the order of choosing does not have to be considered, we refer to ***Combinations***. A **combination** is a subset of the number of **permutations** and as such, the number of **combinations** for a particular situation is always less than the number of **permutations**.

The expression for evaluating **combinations** is as follows:

If "**n**" is the size of the sample space, and "**r**" is the number of items chosen on each trial, then the total number of **combinations** is written as:

$_{n}C_{r}$ and is calculated as $_{n}C_{r} = \dfrac{n!}{r!(n-r)!}$

<u>Example 1</u>

A baseball team with 12 players is allowed to send four players to a weekend batting clinic. In how many ways can the group be chosen?

<u>Solution</u>

Since order is not important, the group is a **combination**. You are choosing a **combination** of 4 from a group of 12.

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

$n = 12$

$r = 4$

${}_{12}C_{4} = 495$

$${}_{12}C_{4} = \frac{12!}{4!(12-4)!}$$

$${}_{12}C_{4} = \frac{12!}{4!\,8!}$$

$${}_{12}C_{4} = \mathbf{495}$$

and means to multiply

Example 2

A committee of size 4 and a committee of size 3 are to be assigned from a group of 10 people. How many ways can this be done if no person is assigned to both committees?

Solution

1st Committee

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

$${}_{10}C_{4} = \frac{10!}{4!(10-4)!}$$

$${}_{10}C_{4} = \frac{10!}{4!\,6!}$$

$${}_{10}C_{4} = 210$$

2nd Committee

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

$${}_{6}C_{3} = \frac{6!}{3!(6-3)!}$$

$${}_{6}C_{3} = \frac{6!}{3!\,3!}$$

$${}_{6}C_{3} = 20$$

Committee of size 4 AND Committee of size 3

$$210 \times 20$$

$$= 4200 \text{ ways}$$

There are 4200 ways to form a committee of size 4 and a committee of size 3 from a group of 10 people if no person is assigned to both committees.

① $n = 7$ $\quad {}_{7}C_{4} =$

$r = 4$