Combinations

Consider a set of size n. The number of subsets of size r, where $0 \le r \le n$, is

$$\binom{n}{r} = \frac{n!}{(n-r)!\, r!}$$

read "n choose r"

This number is the same as the number of ways that r objects can be selected from n objects where the order of selection is irrelevant.

proof: Given n objects, there are $n(n-1)\cdots(n-(r-1))$ ways to select r objects from the n where order is relevant, [illegible]. Each group of r items will be counted $r!$ times in this count. Hence the number of ways r objects can be selected from n objects where the order of selection is irrelevant is

$$\frac{n(n-1)\cdots(n-(r-1))}{r!} = \frac{n!}{(r-1)!\, r!}$$