Counting example: Suppose we have a 52 card deck, pick 5 cards, without replacement, and without keeping track of the order of selection. Know if we kept of the order of selection, there are

\[(52)(51)(50)(49)(48) = \frac{52!}{47!}\] ways to pick the cards.

Each 5-tuple appears 5! times in this list. Why?

So we overcounted originally by a factor of 5!. So if we went back and ignored the order of selection, there are \[\frac{52!}{47!5!} = \binom{52}{5}\] ways to pick 5 cards without replacement and without keeping track of the order of selection.

In general, n items, choose r of them without replacement, there are \((\text{n})(\text{n}-1)\cdots(\text{n}-r+1) = \frac{n!}{(n-r)!}\) ways to pick if we keep track of the order of selection. Know this!

Now if we ignore the order of selection, each r-tuple appears r! times in a list such as the one above, so we overcounted by a factor of r!. So \[\frac{n!}{(n-r)!r!} = \binom{n}{r}\] ways to pick r out of n items without replacement and without regard to the order of selection.