Theorem. # of permutations of a set $S$ of size $k$ is $k! = k(k-1)(k-2)\cdots 1$.

Proof. Use generalized product rule $n = n_1 n_2 \cdots n_k$

Divisor rule

Division rule

Theorem. # of permutations of a length $l$ sequence of elements from $S$, $1 \leq l \leq k$, is $\frac{k!}{(k-l)!}$.

Proof. At a set of permutations of $S$,

$$\text{B} = \text{set of length } l \text{ sequences from } S$$

$$\text{F}(a) = \text{the } (a) \text{ such that } a \in \text{B}$$

Corollary. # of ways to buy $8$ donuts 3 types is 200
Corollary. # of ways to buy 5 donuts 3 types is 
\[ \binom{12}{2} \]

c = 66
(1, 1, 0, 0, 0, 0, 0, 0, 0)