$\max\{x_1 \cdots x_n\}$

$\boxed{m \leftarrow 1}$

for $i \leftarrow 2$ to n do $i{+}{+}$ $j \leftarrow i{+}{+}$

  if $\boxed{x_i > x_m}$ then

    $\boxed{m \leftarrow i}$ → ?

min 0

max $n-1$

AVERAGE

$n-1$ times

k times

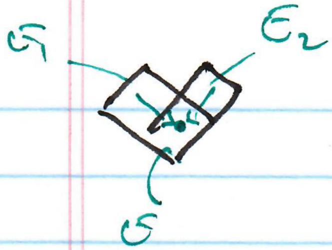
formula in terms of n and k

__Rule of Sum__

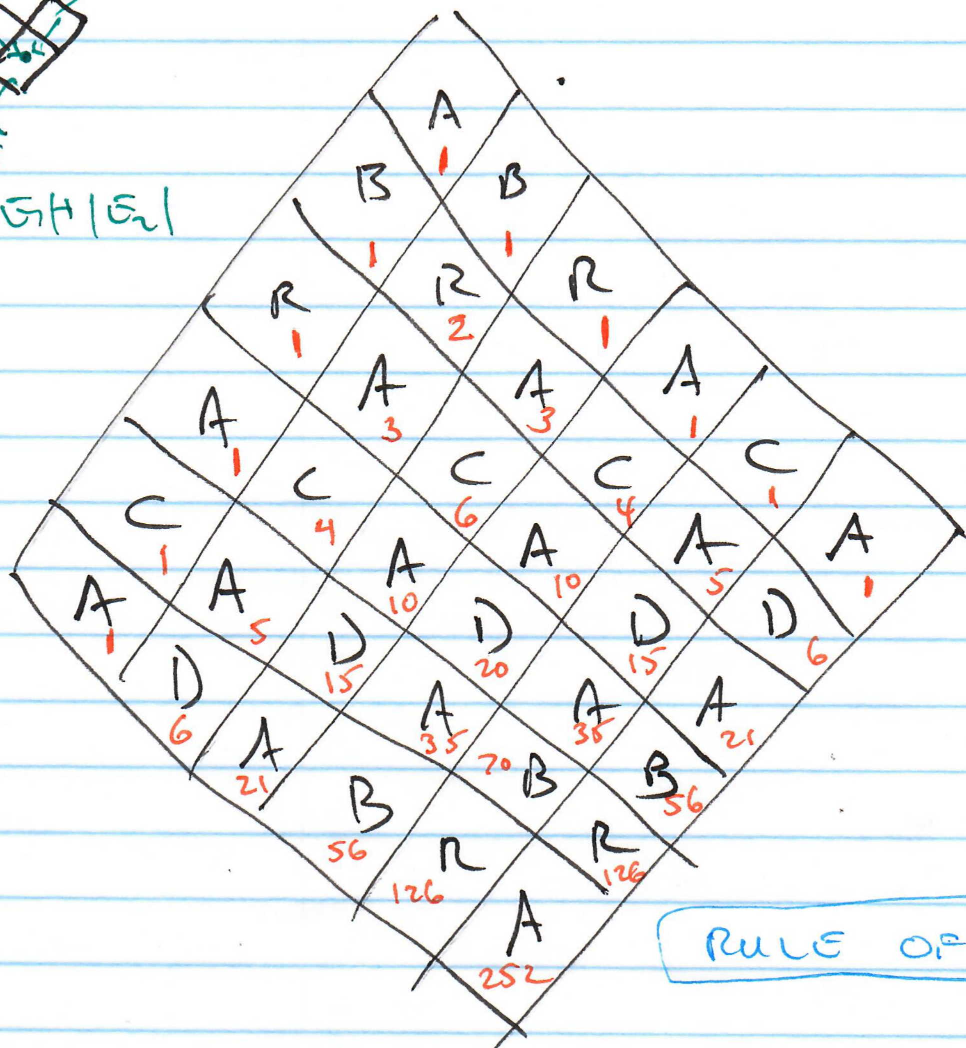
If an event E composed of event E_1 or E_2 and E_1 can happen in $|E_1|$ ways and E_2 can happen in $|E_2|$ ways, __then__ $E = E_1 + E_2$ can happen in $|E_1| + |E_2|$ ways

__Rule of Product__

If an event E composed of events E_1 and E_2 and E_1 can happen in $|E_1|$ ways, ~~and~~ E_2 can happen in $|E_2|$ ways __then__ $E = E_1 \wedge E_2$ can happen in $|E_1| \times |E_2|$ ways



$|E| = |E_1| + |E_2|$



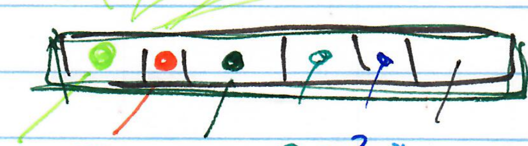
RULE OF SUM

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1
⋮

Rule of Product

A B C D E F

6



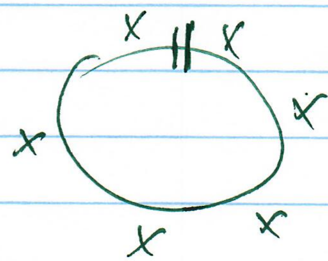
$6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720$

$n(n-1)(n-2)\cdots 1$

$= n!$

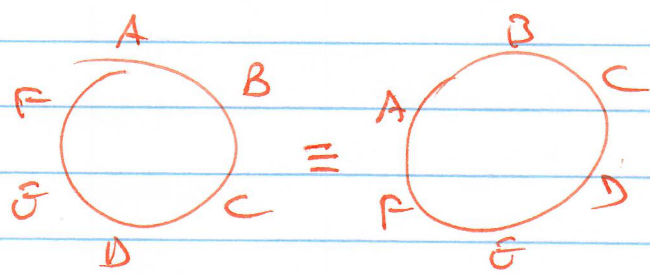
(n factorial)

n people



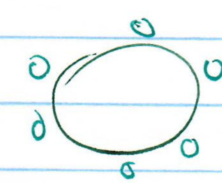
DEFINE

$0! = 1$



$$\boxed{\begin{aligned} n! &= n \times (n-1)! \\ &= 1 \quad n=0 \end{aligned}}$$

ways to arrange n students in row = # arrangements in a circle × open circle

 =  × n ways

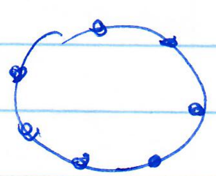
$n!$

How many?

$\frac{n!}{n}$ $\underline{(n-1)!}$

$B_1 \quad B_2$

$B_1 \; B_2 \; B_3 \cdots B_n$



# of arrangements on a circle = $\boxed{\text{rosary } \frac{(n-1)!}{2}}$

up or down

2

$(n-1)!$

$$\#\text{ necklace arrangements} = \begin{cases} 1 & n = 0,1,2 \\ \frac{(n-1)!}{2} & n \geq 3 \end{cases}$$

Rule of Sum

$$E = E_1 + E_2$$

$$|E| = |E_1| + |E_2| \qquad E_1 \cap E_2 = \emptyset$$

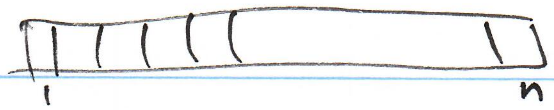
$$|E| = |E_1| + |E_2| - |E_1 \cap E_2|$$

$$E_1 \quad E_2 \quad E_3$$

$$|E| = |E_1| + |E_2| + |E_3|$$
$$- |E_1 \cap E_2| - |E_1 \cap E_3| - |E_2 \cap E_3|$$
$$+ |E_1 \cap E_2 \cap E_3|$$

$$|E| = |E_1| + |E_2| + |E_3| + |E_4|$$
$$- |E_1 \cap E_2| - |E_1 \cap E_3| - |E_1 \cap E_4| - |E_2 \cap E_3| - |E_3 \cap E_4| - |E_2 \cap E_4|$$
$$+ |E_1 \cap E_2 \cap E_3| + |E_2 \cap E_3 \cap E_4| + |E_1 \cap E_3 \cap E_4| + |E_1 \cap E_2 \cap E_4|$$
$$- |E_1 \cap E_2 \cap E_3 \cap E_4|$$

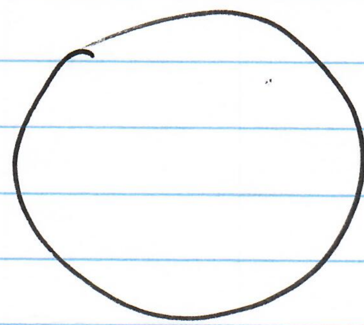
$\boxed{\text{Principle of Inclusion Exclusion}}$



$n!$

D_n = <u>derangements</u> of n items

$2n$ people
$M_1, M_2 \cdots M_n$
$W_1, W_2 \cdots W_n$



Ménage

$\boxed{\text{Google}}$