$${}_{10}C_4 = \frac{10!}{4!(10-4)!}$$

or

$$\frac{10 \cdot 9 \cdot 8 \cdot 7}{4!}$$

5b

200 students have tickets

3 prizes.

$$\underline{200} \cdot \underline{199} \cdot \underline{198} = 7.8 \times 10^6$$

if prizes the same ....

$$\frac{200 \cdot 199 \cdot 198}{3!} =$$

13

$${}_{100}C_{2} = {}_{100}C_{98}$$

$$\frac{100!}{2!(100-2)!} \qquad \frac{100!}{98!(100-98)!}$$

$$
\begin{array}{ccccccccccc}
 & & & & & 1 & & & & & \\
 & & & & 1 & & 1 & & & & \\
 & & & 1 & & 2 & & 1 & & & \\
 & & 1 & & 3 & & 3 & & 1 & & \\
 & 1 & & 4 & & 6 & & 4 & & 1 & \\
1 & & 5 & & 10 & & 10 & & 5 & & 1
\end{array}
$$

$$
\begin{array}{cccccc}
{}_1C_0 & {}_1C_1 & & & & \\
{}_2C_0 & {}_2C_1 & {}_2C_2 & & & \\
{}_3C_0 & {}_3C_1 & {}_3C_2 & {}_3C_3 & & \\
{}_4C_0 & {}_4C_1 & {}_4C_2 & {}_4C_3 & {}_4C_4 & \\
{}_5C_0 & {}_5C_1 & {}_5C_2 & {}_5C_3 & {}_5C_4 & {}_5C_5
\end{array}
$$

$$(a+b)^5$$

$$= 1a^5 + 5a^4b^1 + 10a^3b^2 + 10a^2b^3 + 5ab^4 + b^5$$

Permutations where not all objects are distinguishable.

Q: clearly just using $n!$ for n-things is over counting . . .

so what to do?

ex ALÂSKÀ

$6!$ would be the # of rearrangements

ALÂSKÀ　　ALÀSKÂ

ÂLASKÀ　　ÂLÀSKA

ÀLASKÂ　　ÀLÂSKA

A: $6!/3!$

AAALSK

ex MISSISSIPPI

rearrangements

$$\frac{11!}{4!\cdot 4!\cdot 2!} = \frac{11(10)\cdot 9\cdot 8\cdot 7\cdot 6\cdot 5}{4!\cdot 2!}$$

$$= 11(5)\cdot 9\cdot 2\cdot 7\cdot 5$$

$$= 55\cdot 18\cdot 35$$

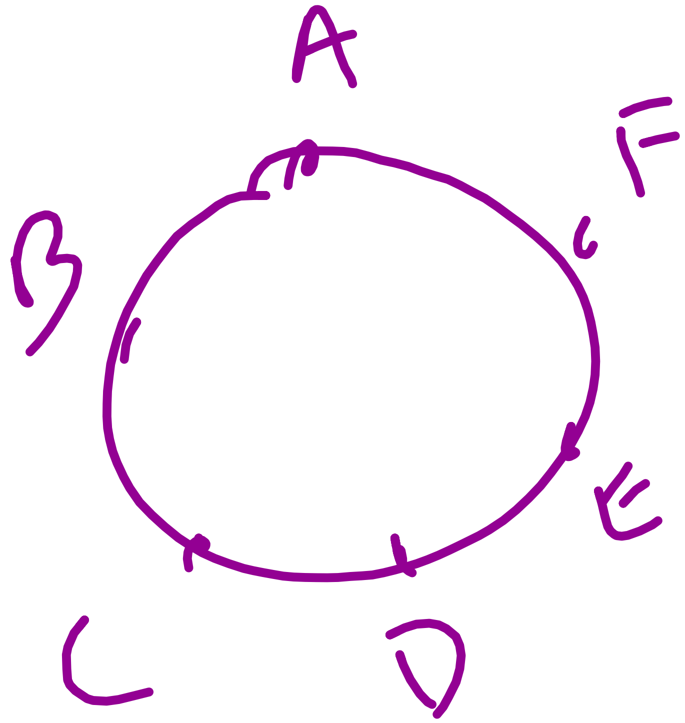
$$= 34{,}650.$$

generally if n things

r_i things the same

then number of rearrangements

is $\dfrac{n!}{r_1!\,r_2!\cdots}$



$6!$

double counting

A B C D E F
B C D E F A
C D E F A B
D E F A B C
E F A B C D
F A B C D E

$A: \frac{6!}{6}$