How many ways can you arrange the letters in

Banjo

$5! = 120$ ways

How many ways can you arrange the letters in

Booger

The problem is that these letters are the same. So for example we can't tell the difference between these two arrangements

ROBGOE ROBGOE

Which O is which O ?

☆ It doesn't Matter

We have to divide out that double O problem to resolve this

To arrange 6 letters is $6!$

To arrange 2 O's is $2!$ ← divide out

$\Rightarrow \frac{6!}{2!} = 6 \cdot 5 \cdot 4 \cdot 3 = 360$

How many ways can you arrange the letters in

MISSISSIPPI

11 total letters ⇒ 11!
4 I's ⇒ 4!
4 S's ⇒ 4!
2 P's ⇒ 2!

$$\frac{11!}{4!\,4!\,2!} = \frac{11\cdot10\cdot9\cdot8\cdot7\cdot6\cdot5}{4\cdot3\cdot2\cdot1\cdot2\cdot1} = 34{,}650$$

How many different ways can 3 red, 4 yellow, and 2 blue bulbs be arranged in a string of halloween lights with 9 sockets?

$$\frac{9!}{3!\cdot4!\cdot2!} = 1260$$

How many ways can 6 girls and 2 boys be arranged in a row:

a. Without restriction

$8! = 40,320$

b. Such that the 2 boys are sitting next to each other

(BB) (G) (G) (G) (G) (G) (G) Think of the boys as 1 bubble

To arrange each bubble = $7!$

To arrange the boys within their bubble = $2!$

$7! \cdot 2! = 10,080$

c. Such that the 2 boys are not sitting next to each other

# of All Possible Arrangements − [# of Arrangements where boys sit together]

$40,320 - 10,080 = 30,240$