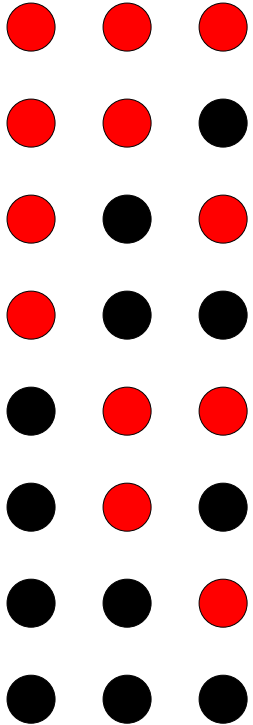


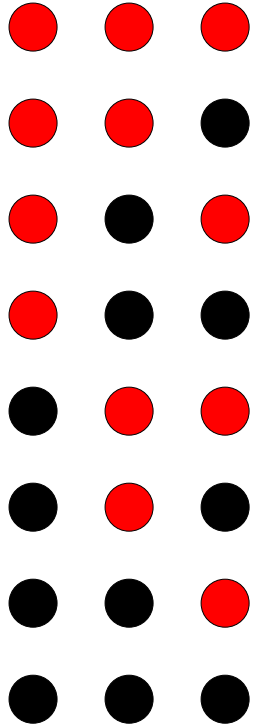
Counting

In how many ways can n balloons be colored red and black?



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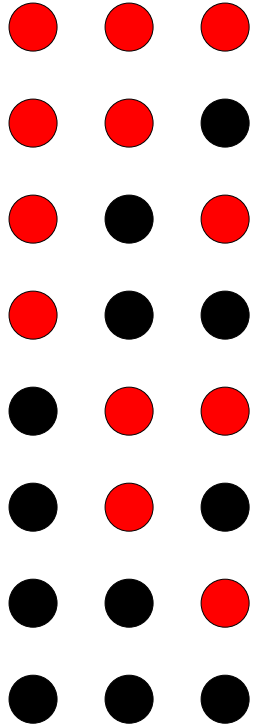


First try: 2 colors for the third position,

2

Counting

In how many ways can n balloons be colored red and black?

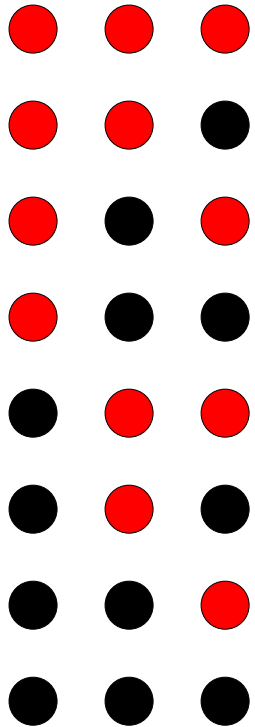


First try: 2 colors for the third position,
for each of those, 2 colors for the second position,

$$2*2$$

Counting

In how many ways can n balloons be colored red and black?

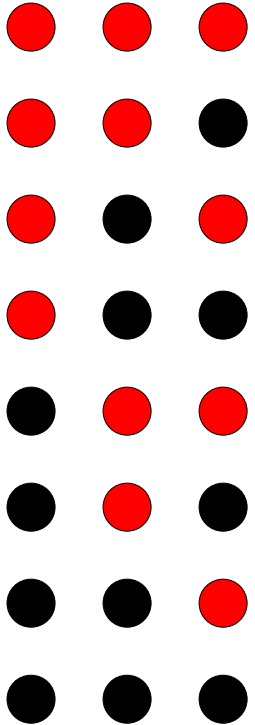


First try: 2 colors for the third position,
for each of those, 2 colors for the second position,
for each of those, 2 colors for the third position

$$2*2*2=8$$

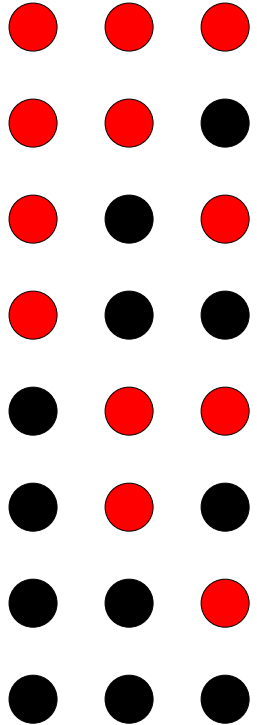
Counting

In how many ways can k of n balloons be colored red?



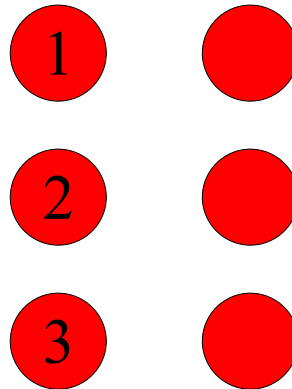
Counting

In how many ways can k of n balloons be colored red?



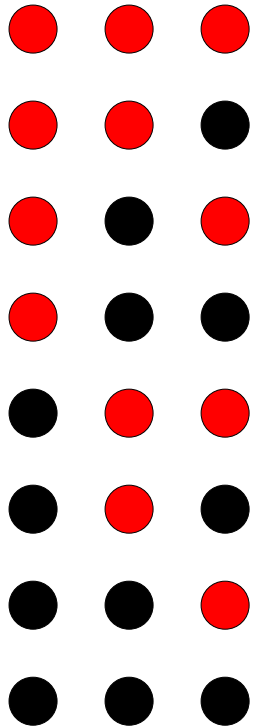
First try: suppose $k=2, n=3$

first of 2 red balloons can get one of three positions



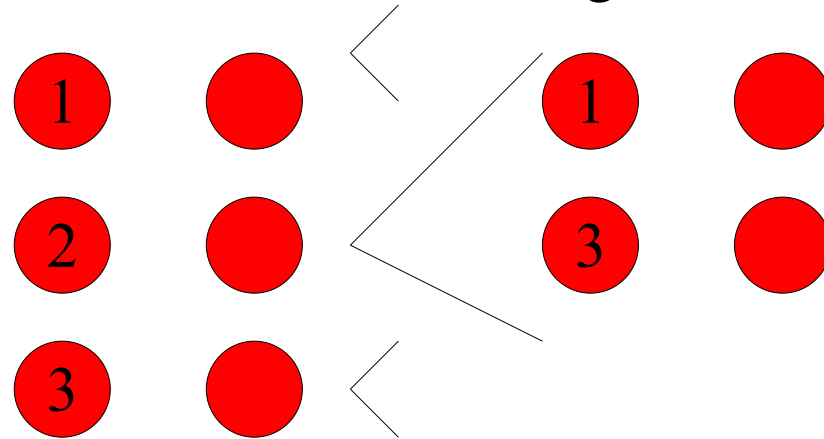
Counting

In how many ways can k of n balloons be colored red?



First try: suppose $k=2, n=3$

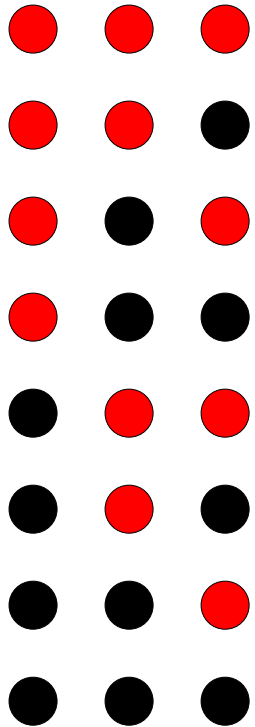
first of 2 red balloons can get one of three positions



So, it looks like $3*2 = 6$

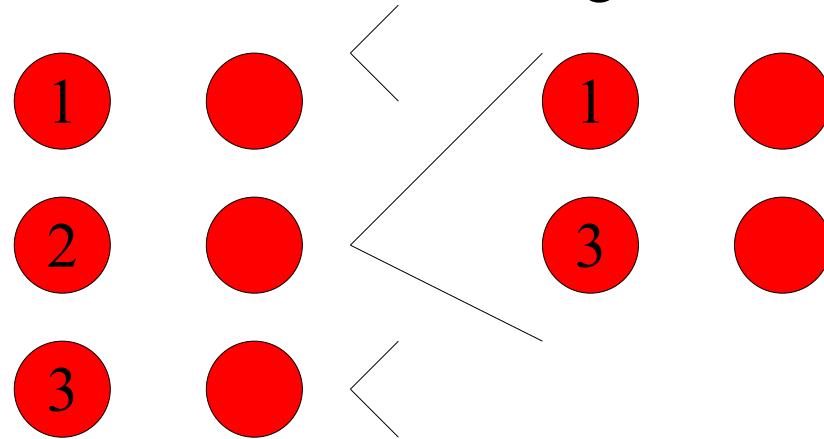
Counting

In how many ways can k of n balloons be colored red?



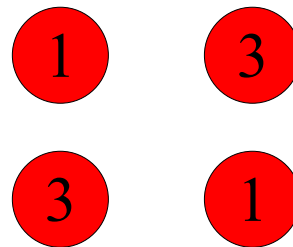
First try: suppose $k=2, n=3$

first of 2 red balloons can get one of three positions



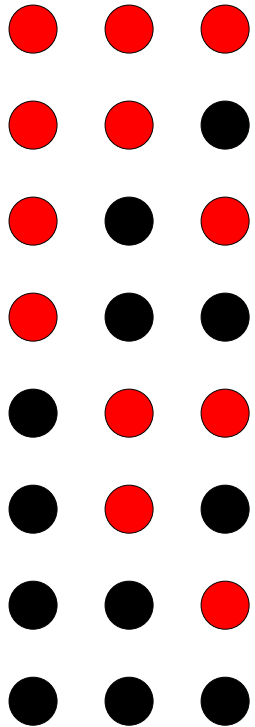
So, it looks like $3*2 = 6$

But that can't be because there are duplicates



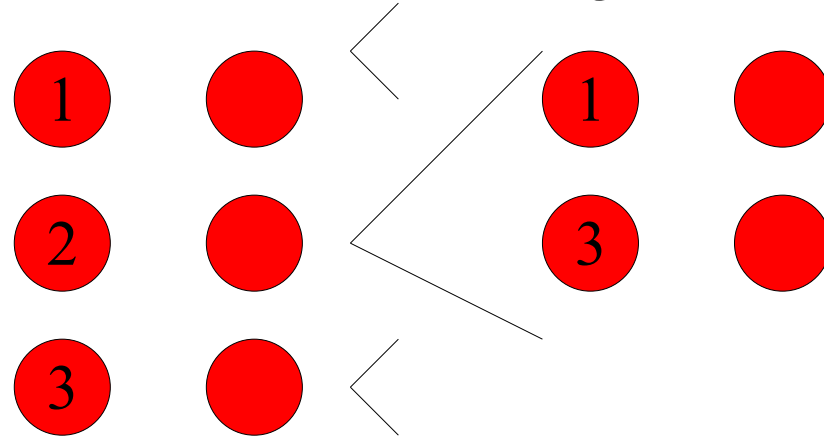
Counting

In how many ways can k of n balloons be colored red?



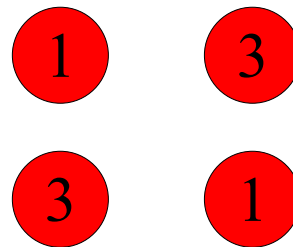
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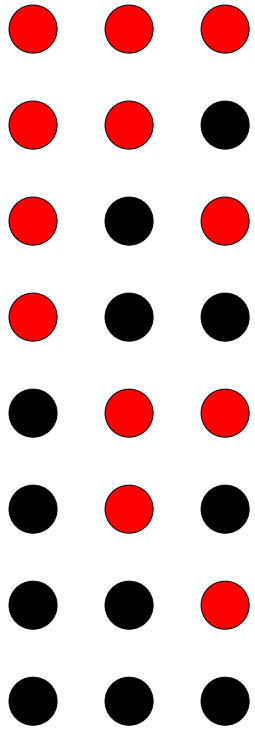
But that can't be because there are duplicates



So, we need to divide by number of ways to permute k numbers

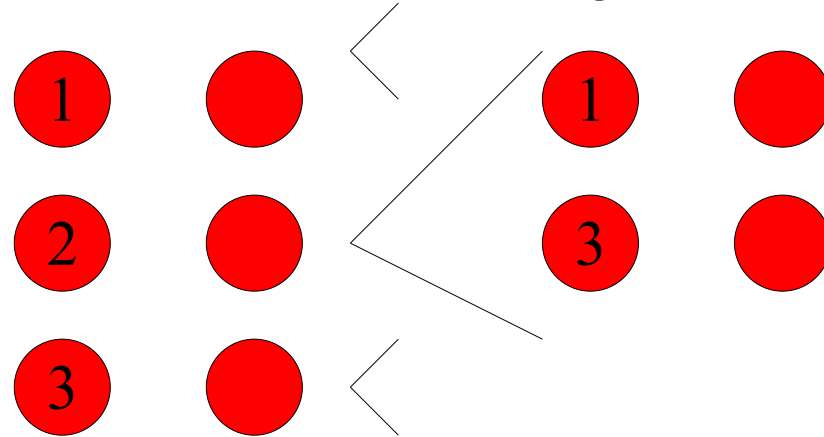
Counting

In how many ways can k of n balloons be colored red?



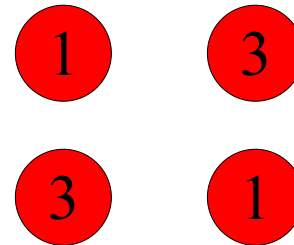
First try: suppose $k=2, n=3$

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But that can't be because there are duplicates

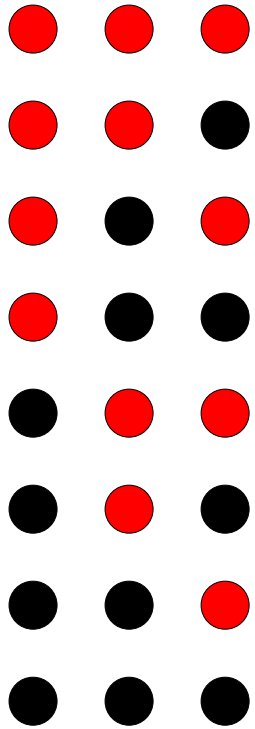


So, we need to divide by number of ways to permute k numbers

$$\frac{n*(n-1)*...*(n-k+1)}{k*(k-1)*...*1}$$

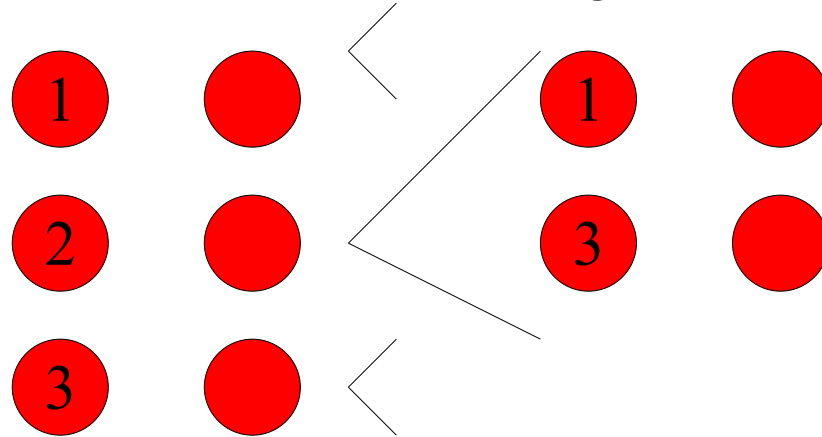
Counting

In how many ways can k of n balloons be colored red?



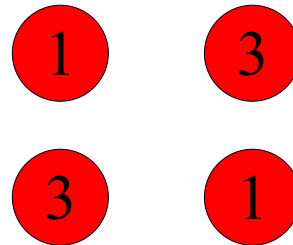
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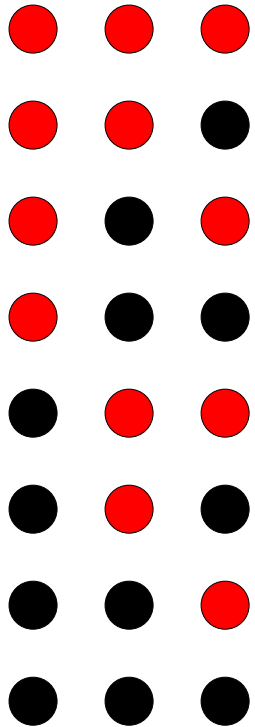
$$\frac{n*(n-1)*...*(n-k+1)}{k*(k-1)*...*1}$$

$$\frac{n!}{k!*(n-k)!}$$

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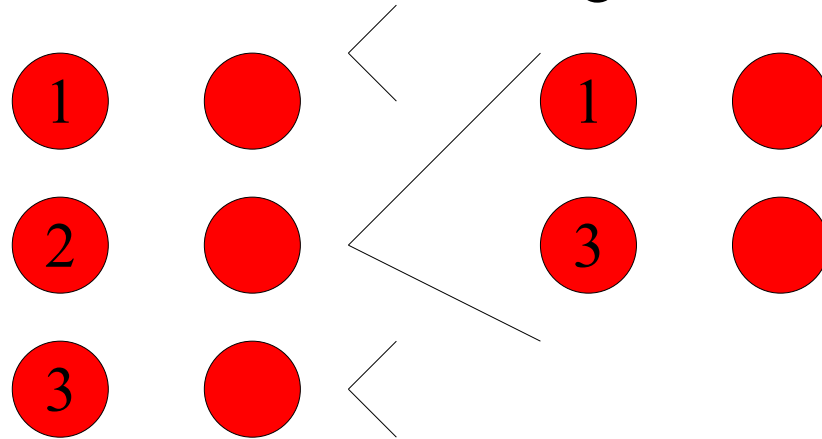
Counting

In how many ways can k of n balloons be colored red?



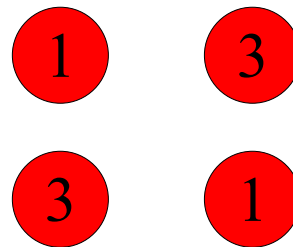
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$$\frac{n*(n-1)*...*(n-k+1)}{k*(k-1)*...*1}$$

$$\frac{n!}{k!*(n-k)!} = \binom{n}{k}$$