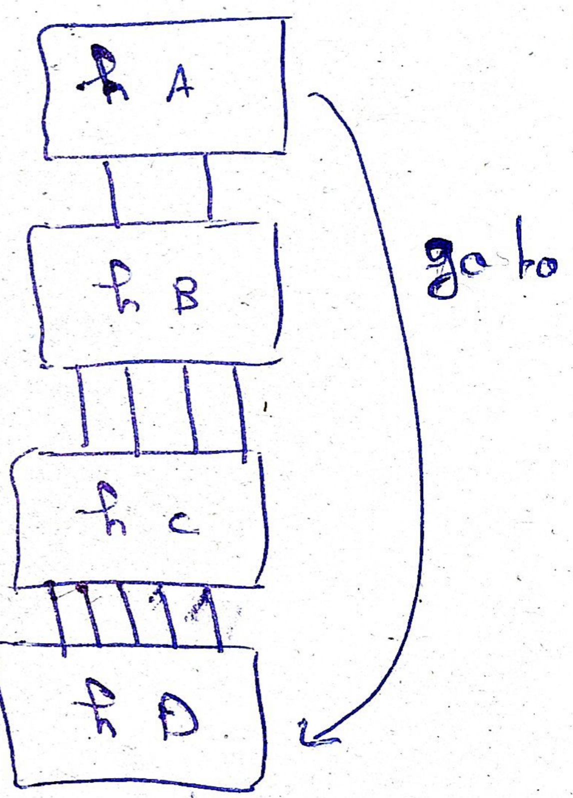
the counting principle

Suppose I wont to go from house A to house D.

* from A to B there are 2 possible routs.
* from B to C there are 4 possible routs
* from C to D there are 5 possible routs

to find the total number of possible ways to go from A to D we use the counting principle

the diff routes are possible are $2 \times 4 \times 5 = 40$ ways.



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1 2 3 4 5

How many 3-digits number can be formed?

1- repetition is allowed.

5	5	5
4	4	4
3	3	3
2	2	2
1	1	1

$5 \times 5 \times 5$

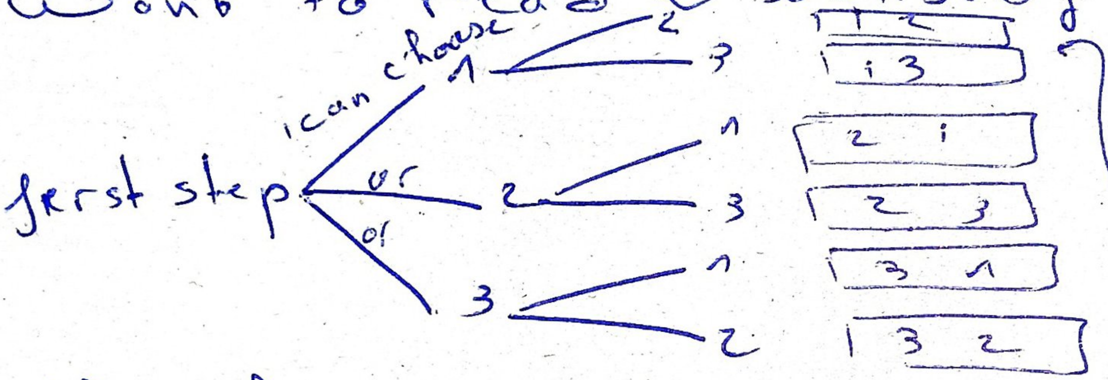
result is 5^3

2- repetition is not allowed (without remplacement)

5	.	
4	.	
3	.	.
2	.	.
1	.	.

$5 \times 4 \times 3$

+ I want to read 2 books out of 3.



6 possibilities

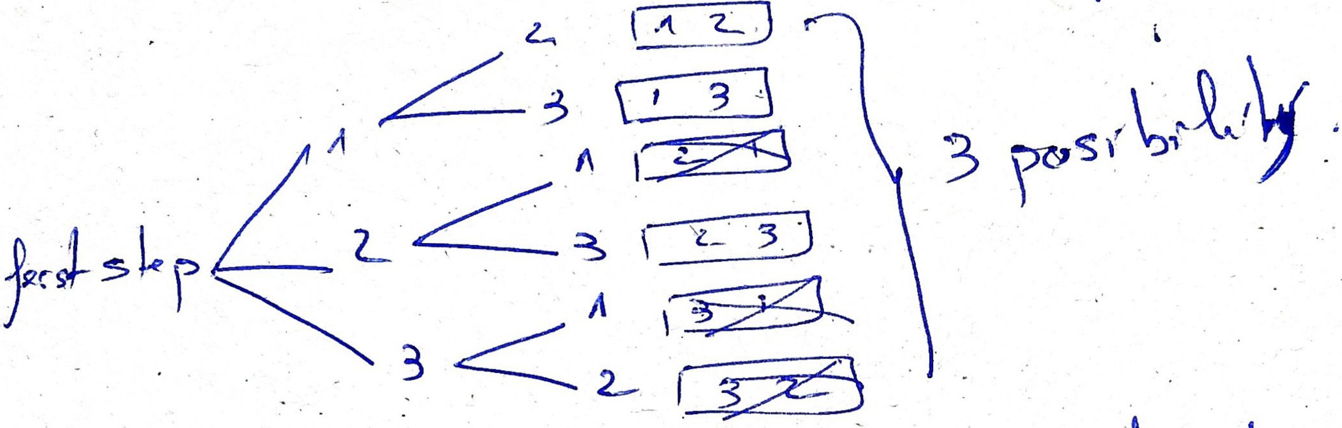
in this place order is considered (the combination of ABC is not the same as CBA).

~~xxxxxxxx~~ in factorial notation is $A_n^r = \frac{n!}{(n-r)!}$

A permutation is an ordered arrangement of objects. the number of permutations of r object selected from a set of n distinct object is $A_n^r = npr = n(n-1)\cdots(n-r+1)$

Combination

I wont read 2 books out of 3



Here, the order is not important

A combination factorial notation is

$$C_n^r = \frac{n!}{(n-r)!\,r!} = \frac{A_n^r}{r!}$$

$$C_3^2 = \frac{3!}{(3-2)!\,2!} = 3$$