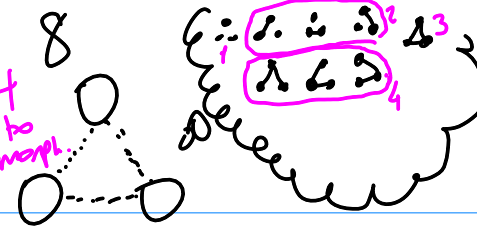
1

2

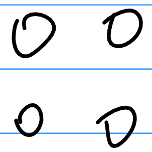
8

4 due to isomorph.

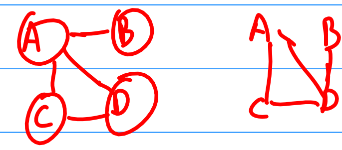


3 possible edges

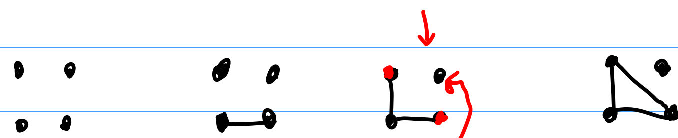
2^3 //



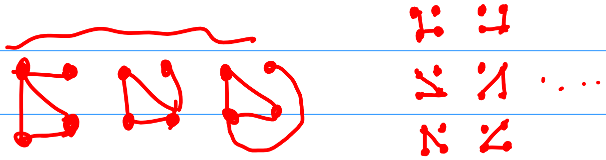
$2^{\binom{4}{2}} = 2^6 = 64$



11 unlabeled graphs



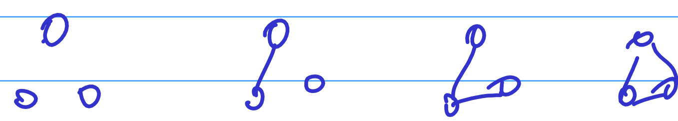
$1 + 6 + \binom{4}{1}\binom{3}{2} = 4.3 = 12 + 4 \dots = 64 \geq 2^{\binom{4}{2}} = 2^6 = 64$



labeled graphs

12 //

For 3 vertices

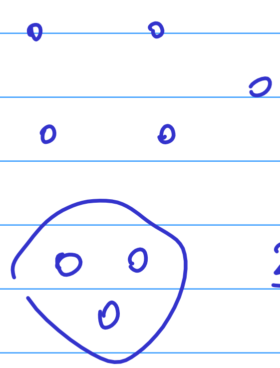


# of different graphs due to isomorphism ?

$$\frac{2^{\binom{n}{2}}}{n!} \leq T_n \leq 2^{\binom{n}{2}}$$

# of labeled graphs

1, 2



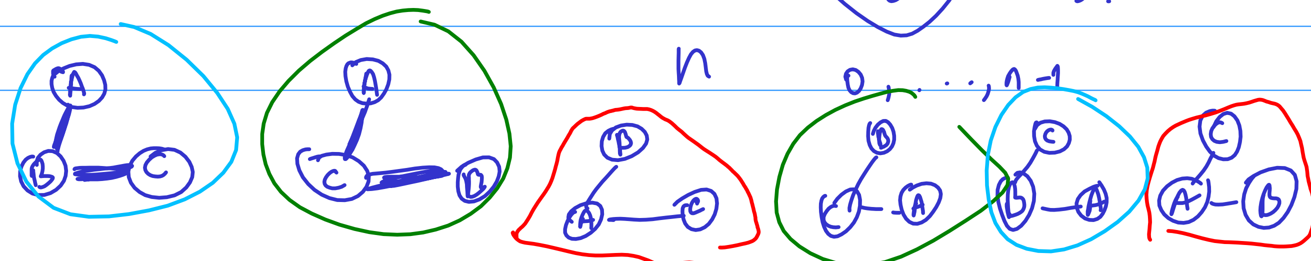
$\frac{2^{10}}{5!} = \frac{1024}{120}$

$\frac{2^3}{3!} = \frac{8}{6} = 1.\bar{3}$

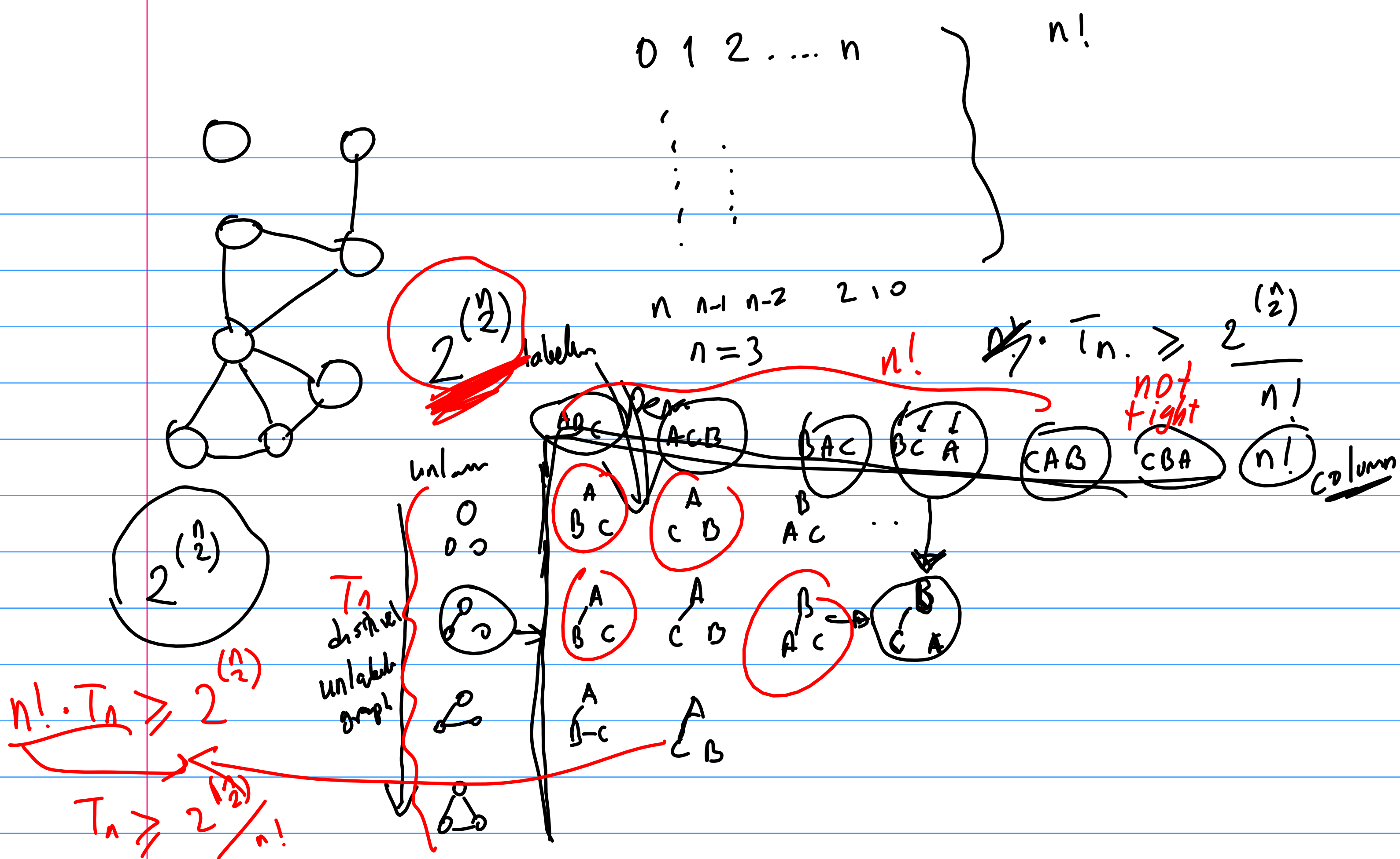
labeled → unlabeled

n

0, . . . , n-1



$\Rightarrow 3!$



Def. Let T_n be the number of distinct unlabelled graphs.

We don't know an explicit formula for T_n so, we want to bound it.

Most straight-forward bounds:

$$\frac{2^{\binom{n}{2}}}{n!} \underset{(2)}{\le} T_n \underset{(1)}{\le} 2^{\binom{n}{2}} \quad \text{why?}$$

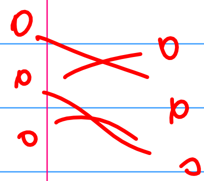
(1) $2^{\binom{n}{2}}$ is the num. of all labelled graps, so this one is trivial

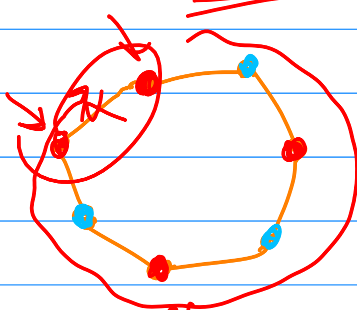
(2) We form a matrix

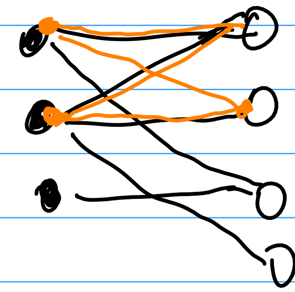
If G is "bipartite" $\Longleftrightarrow$ G has no cycles of odd length

necessity $\Longrightarrow$

construct

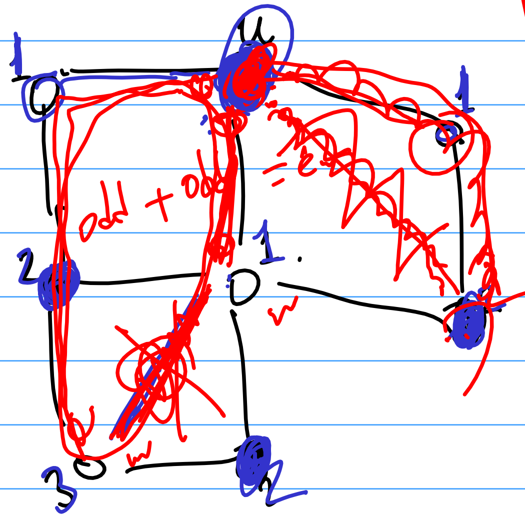


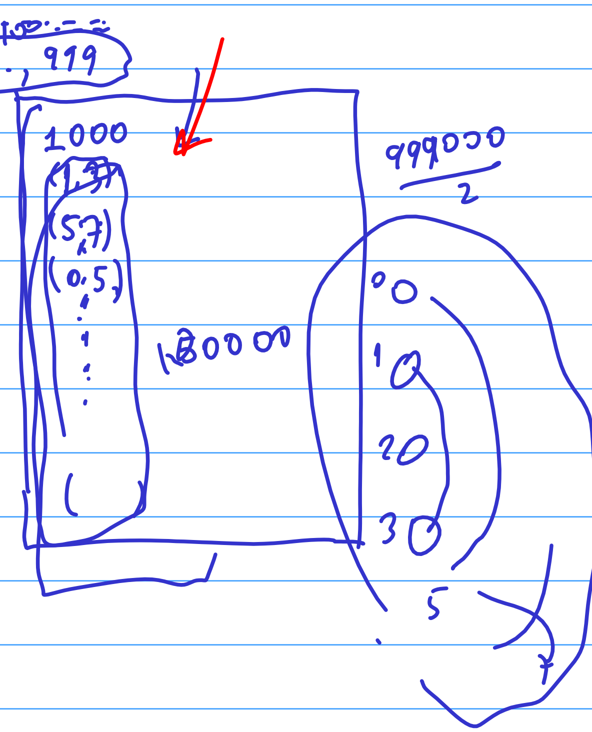


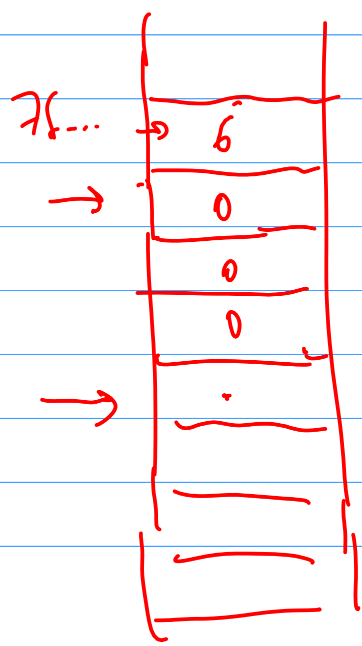


sufficient $\Longleftarrow$

bipartite $\Longleftarrow$ no odd cycles







little endian

1 byte = 8 bits

32 bits