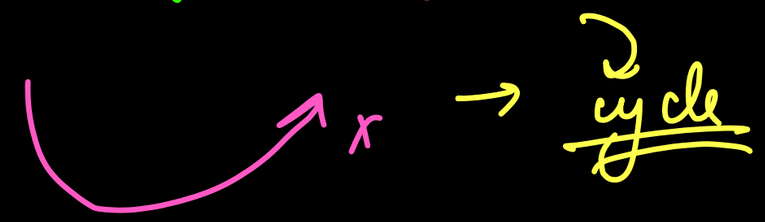
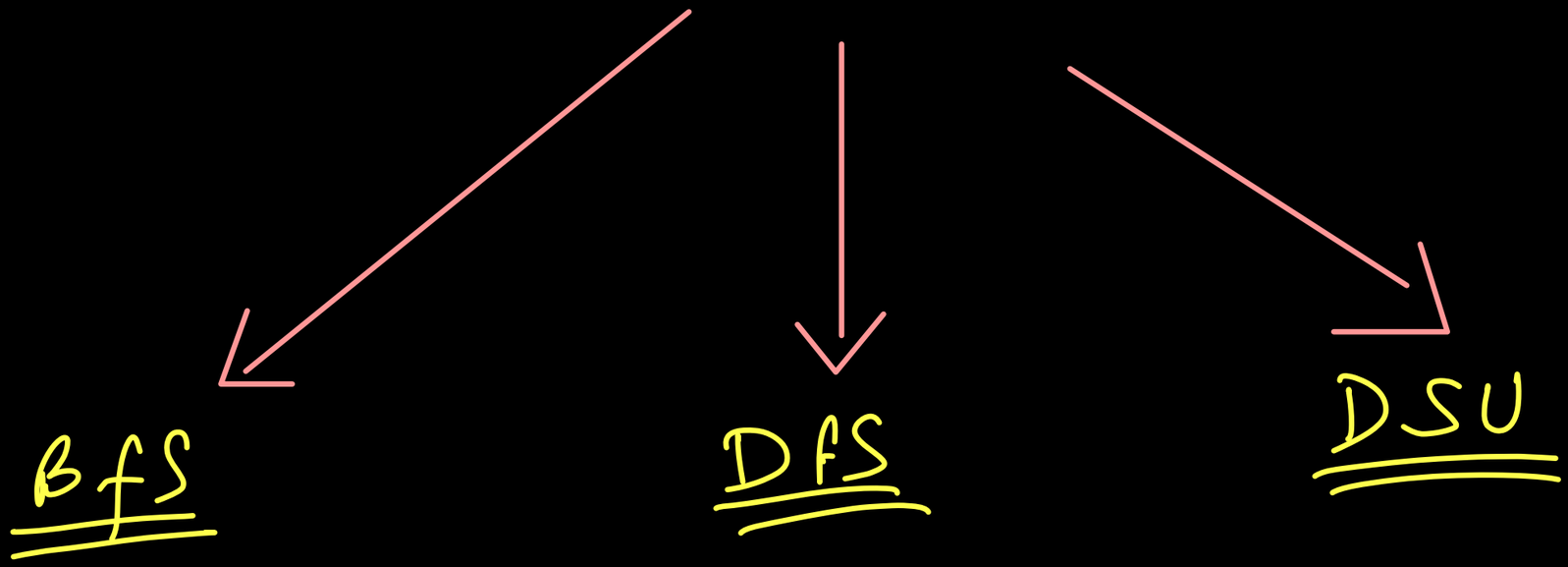
Topological Sorting → DAGs



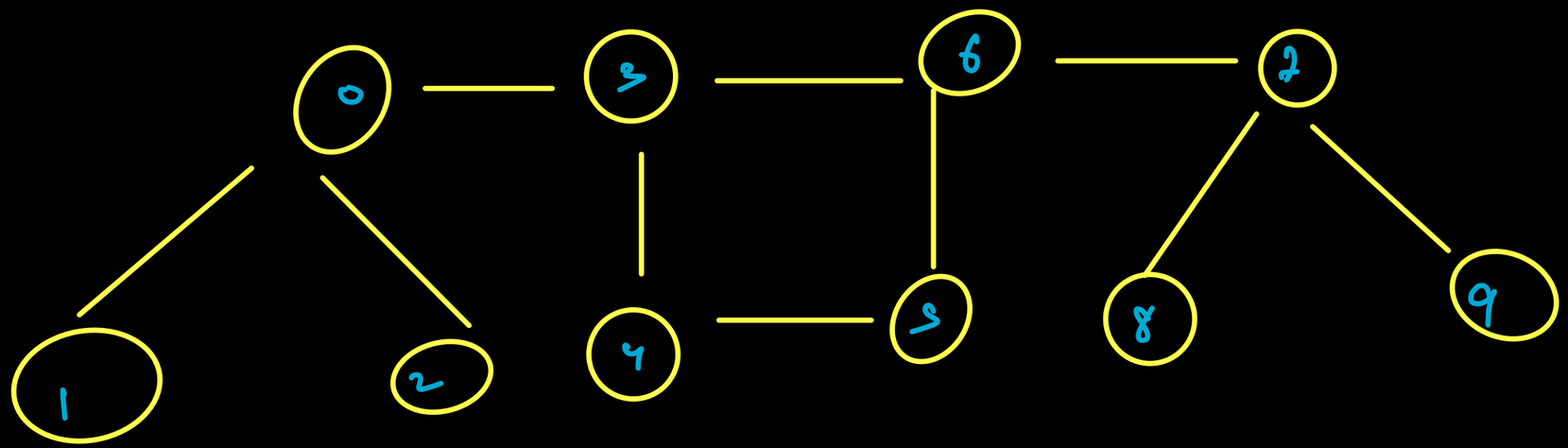
Ex Given a directed graph, detect if it is having cycles or not??

↳ Kahn's algo

Q. How to detect cycle in an undirected graph ??



Cycle detection using DSU

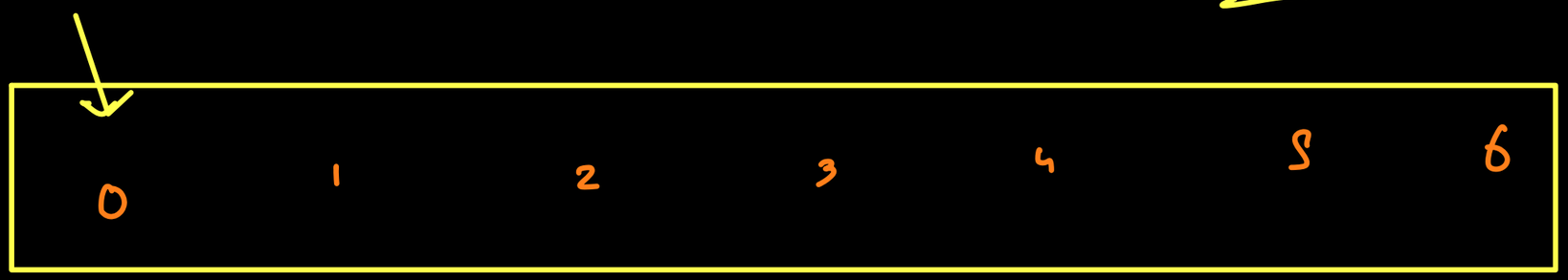


Edge list

```
[ [0,1],
  [0,2],
  [0,3],
  [3,4],
  ⋮
]
```

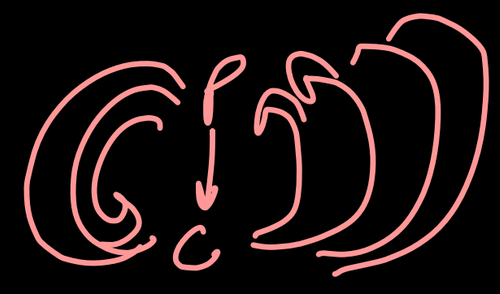
↳ let's create a dsu

x

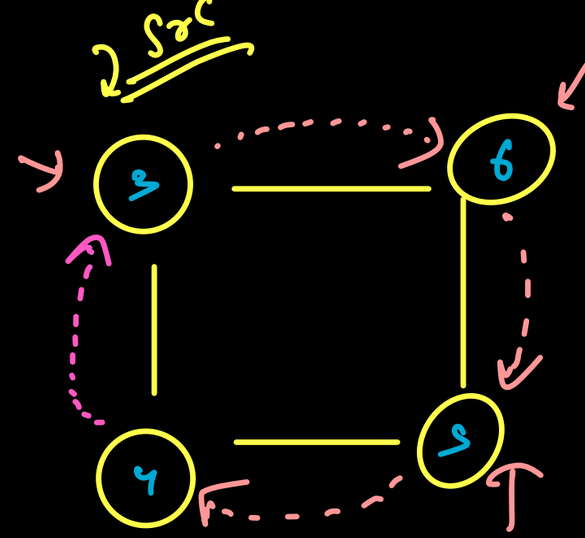


we will read each edge & on the vertices of the edge apply union operation.

Cycle detection using DFS

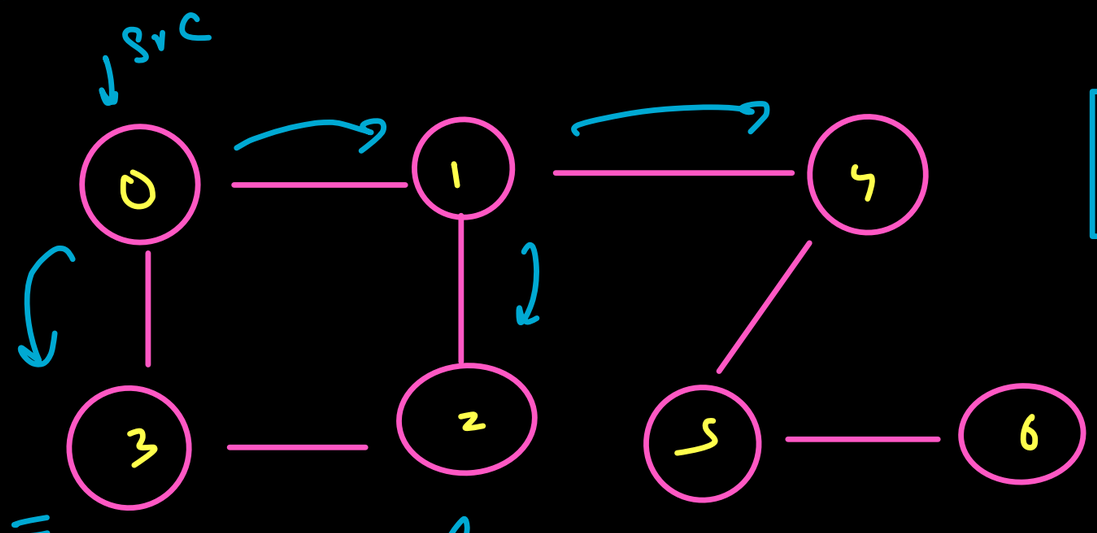


check if the visited is not your parent then there is a cycle



0, 1, 3, 4, 2 — vis

cycle detection using BFS



= cycle

parent

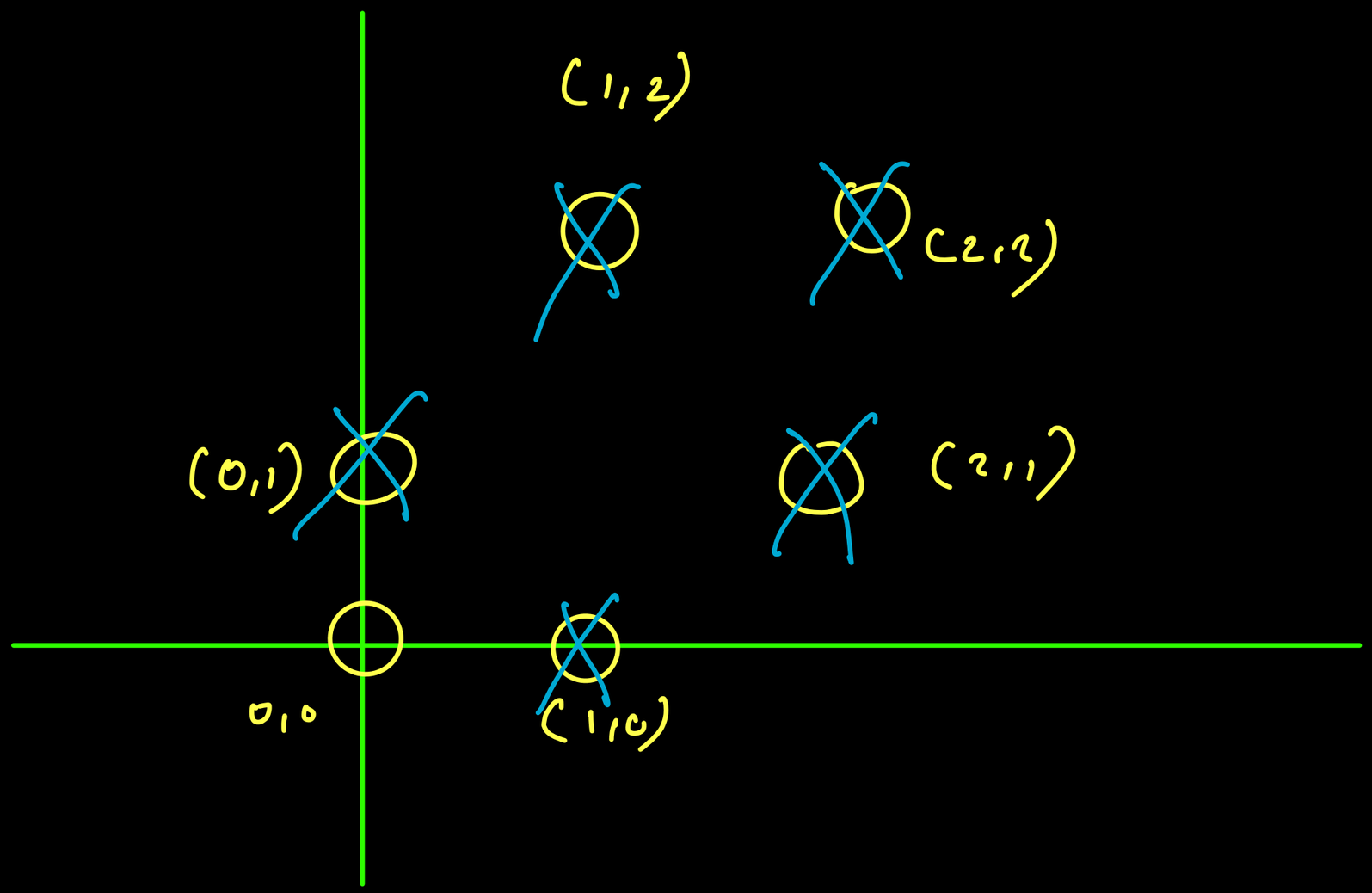
0	1	2	3	4	5	6
-1	0	1	0	1		

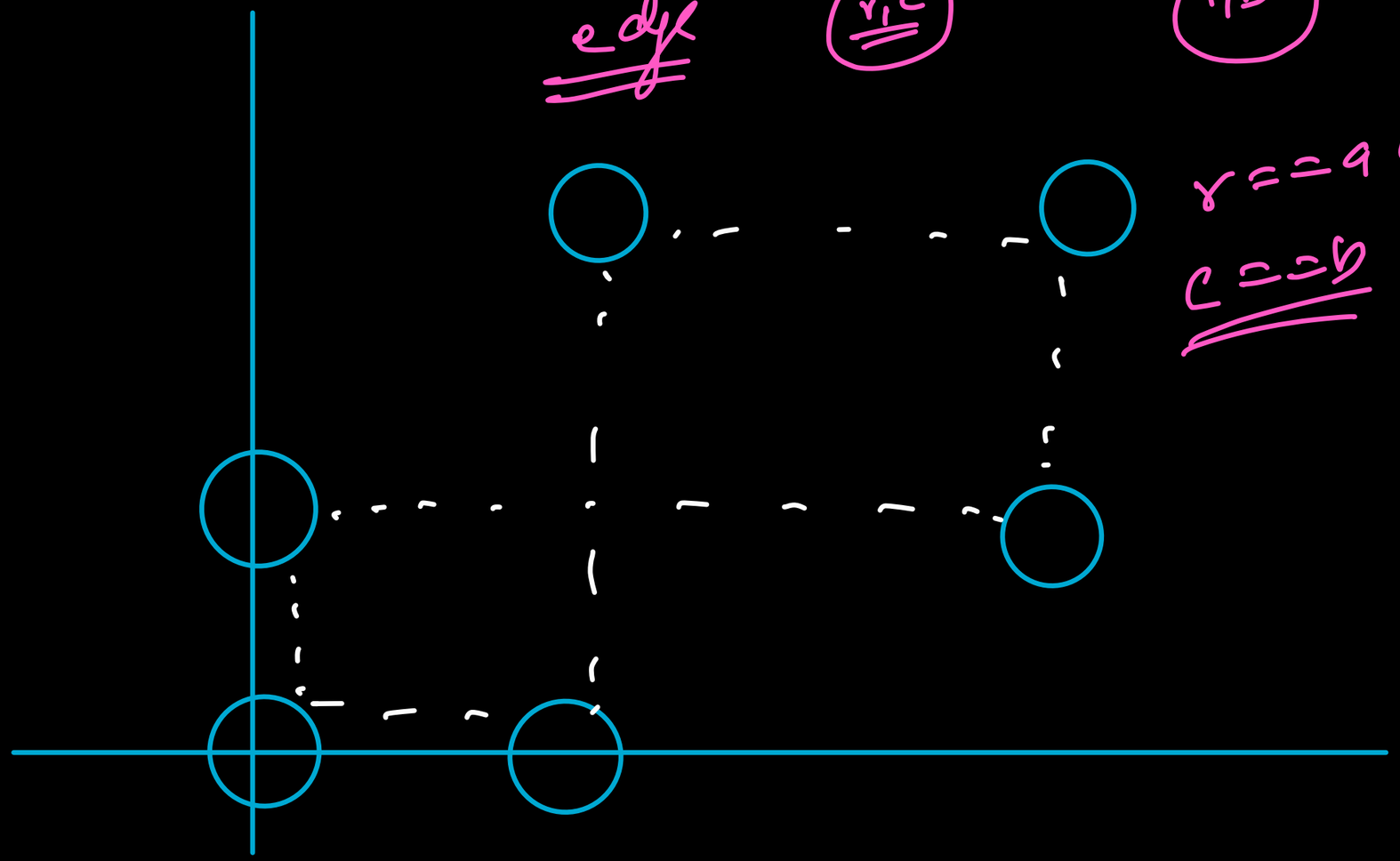
1	4	2	

↳ queue

if a node is already visited & it is not your parent then you have a cycle.

leetcode 947





edge (r, c) (q, b)

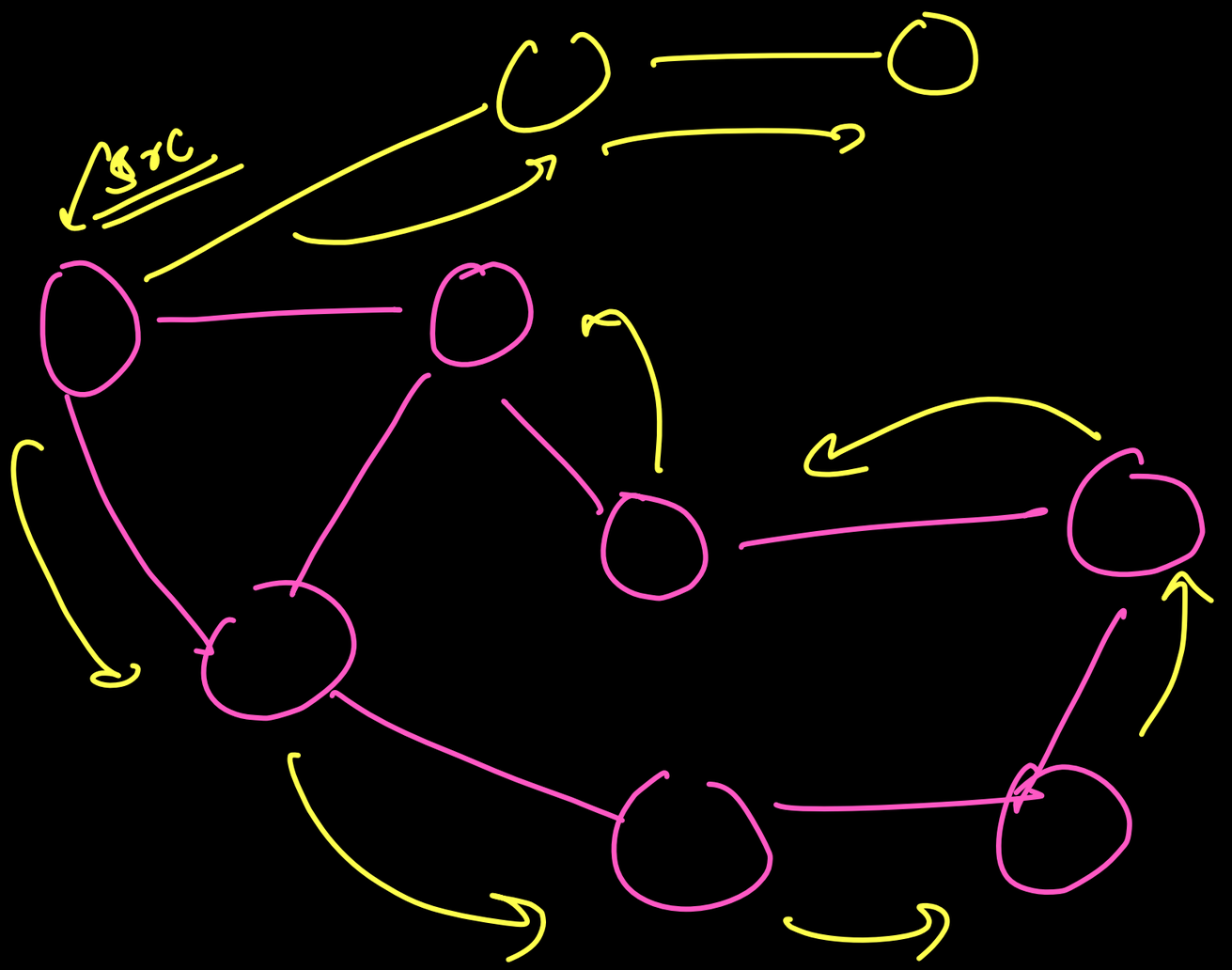
r == q or c == b

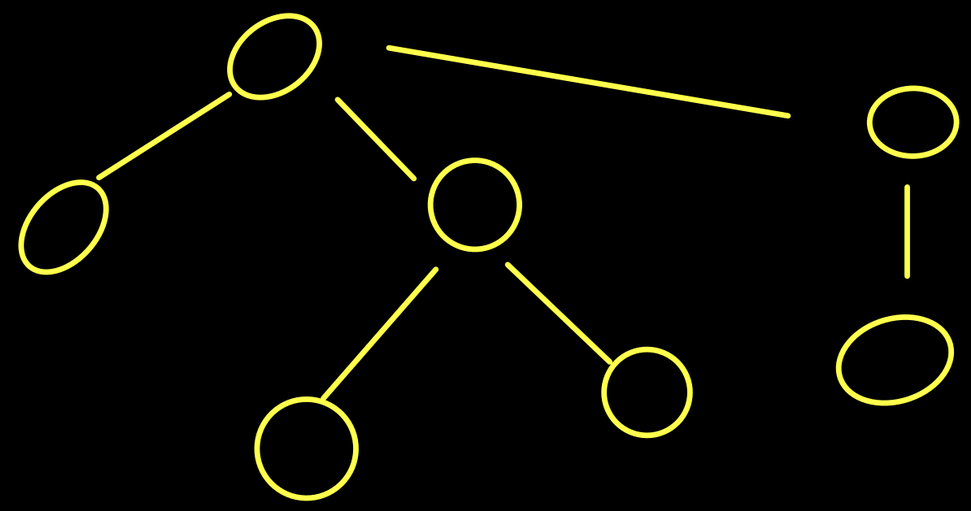
if 2 nodes share their row then they are in same component

or if 2 nodes share their col^n then they are in a same component

↳ Total nodes ⟶ no. of CC

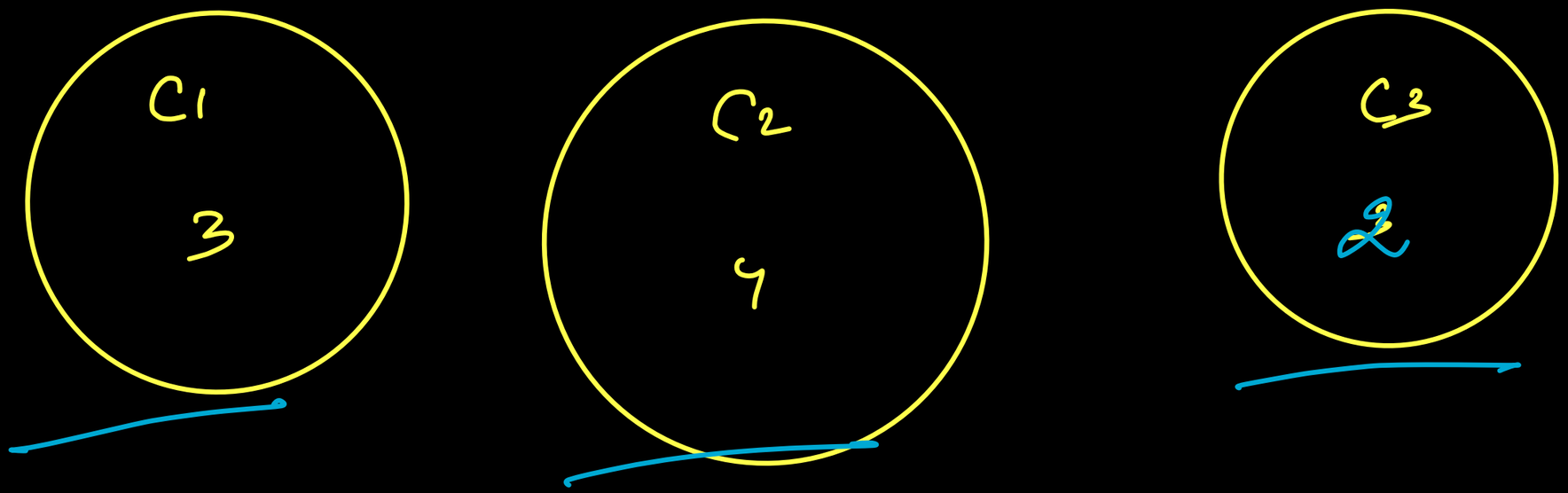
DFS के लिए





JOIN THE DARKSIDE

↳ Disconnected graph ⇒ edge list (DSU) ← Size of CC



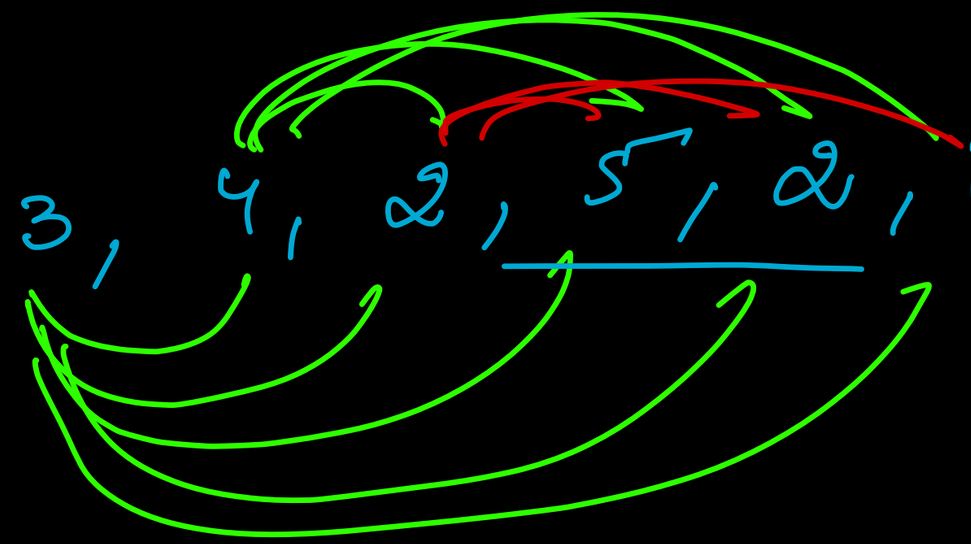
3 x 4 + 4 x 2 + 3 x 2

CC1 CC2 CC3 ..... 10^3

n

n^2

dp



suffix sum

$3 \times 4 + 3 \times 2 + 3 \times 5 + 3 \times 2 + 3 \times 1$

$+ 4 \times 2 + 4 \times 5 + 4 \times 2 + 4 \times 1$

$+ 2 \times 5 + 2 \times 2 + 2 \times 1$

$+ 5 \times 2 + 5 \times 1$

$+ 2 + 1$

$3 \times (4+2+5+2+1)$

$4(2+5+2+1)$

pairs

↳ $S_2 \times (\gamma m - s_2)$