Graph Concepts & Qns

video-44

Leetcode -1245 Medium

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Motivation :-

The one who keeps trying despite every failure is the one who will ultimately emerge victorious.

Success will be his/her destiny

MIK...

Success ... one day...

"Diameter of an undirected Graph"

1245. Tree Diameter

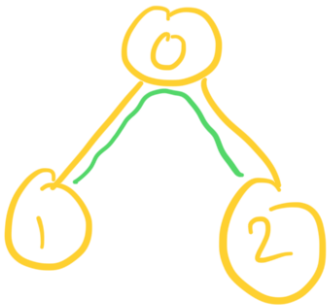
Google, Meta

Given an undirected tree, return its diameter: the number of **edges** in a longest path in that tree.

The tree is given as an array of `edges` where `edges[i] = [u, v]` is a bidirectional edge between nodes `u` and `v`. Each node has labels in the set `{0, 1, ..., edges.length}`.

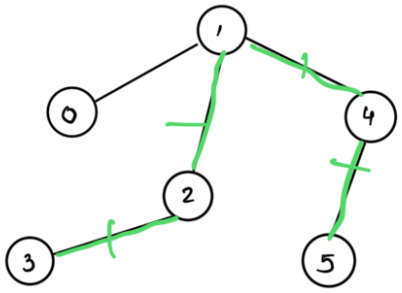
Example :- edges = [(0,1), (0,2)]

Output = 2



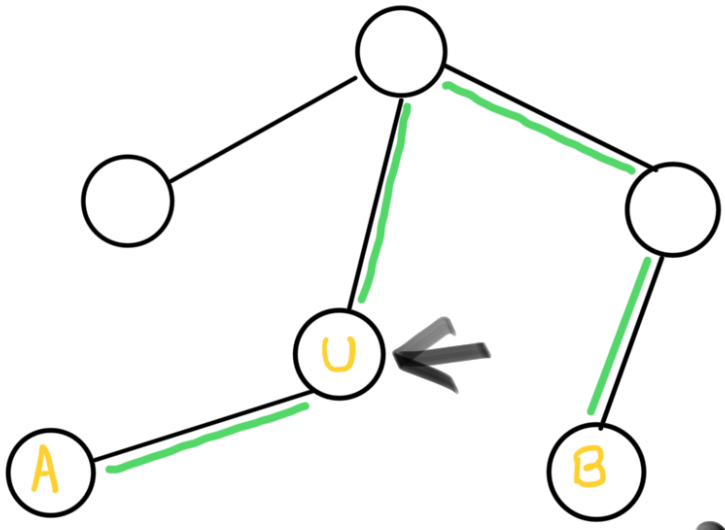
edges = [(0,1), (1,2), (2,3), (1,4), (4,5)]

Output = 4



Diameter - No. of edges in the longest path in graph/tree from any node to any other node.

If you choose a random node (u) and find the farthest node (v) from (u), then this node (v) will always be one end of the Diameter of the graph.



$d(A,B)$

Assumption

$d(u,v) \rightarrow d(u,B) < d(u,v)$

Case-1
u lies in the diameter.

$d(u,A) <= d(u,B)$

$d(u,A) + d(u,B) <= 2 * d(u,B)$

$d(A,B) \quad < = 2 * d(U,B)$

$d(U,B) < d(U,V)$ ✗

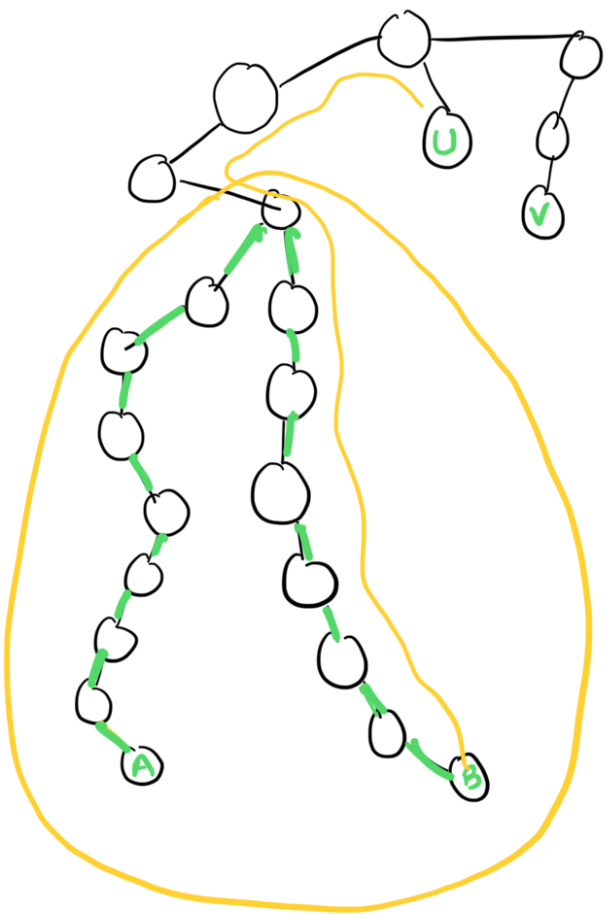
$d(U,B) + d(U,A) < d(U,V) + d(U,B)$

Contradiction

$d(A,B) < d(U,V) + d(U,B)$

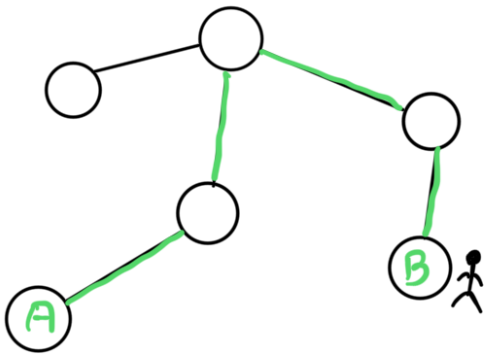
Case-2

U does not lie in the diameter.



$d(A,B)$

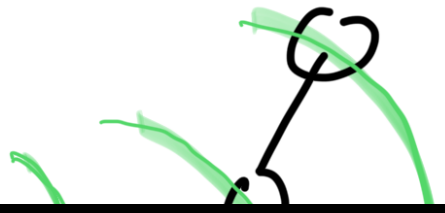
The farthest node from one end of diameter is the other end of diameter.

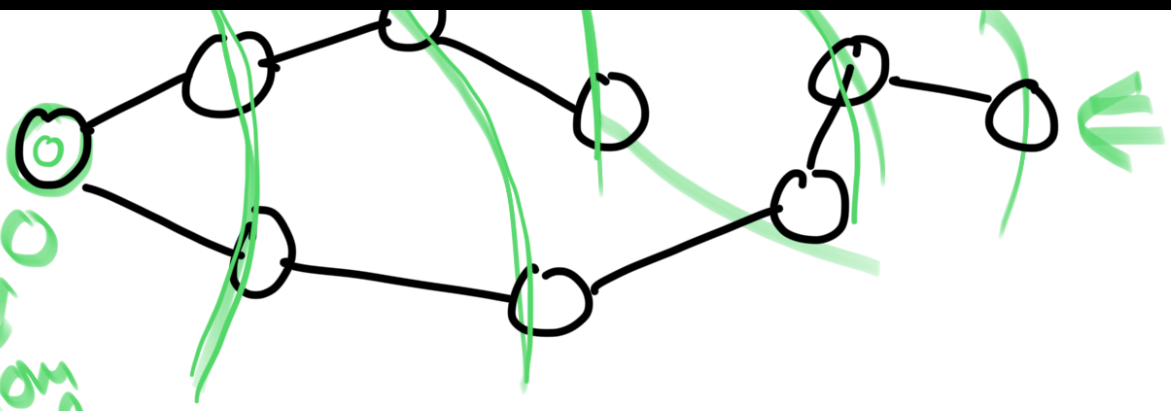


d(A, B) = diameter

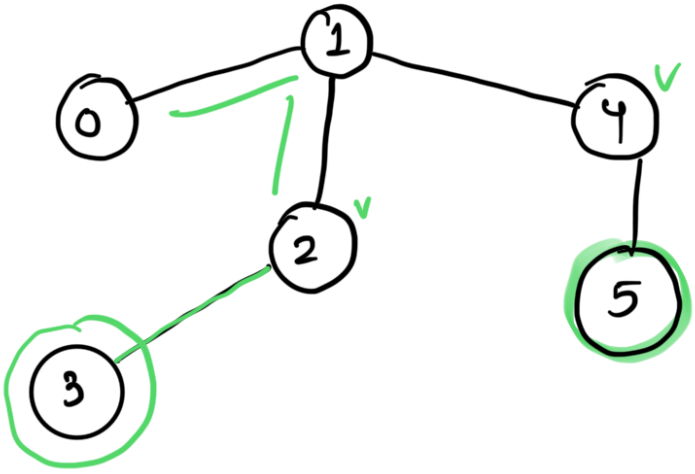
1. U → (farthest) → A/B ✓
2. B → Guaranteed → one end of the Diameter. ✓
3. B → Farthest → A (diameter का दूसरा end)

B → A = diameter का length.



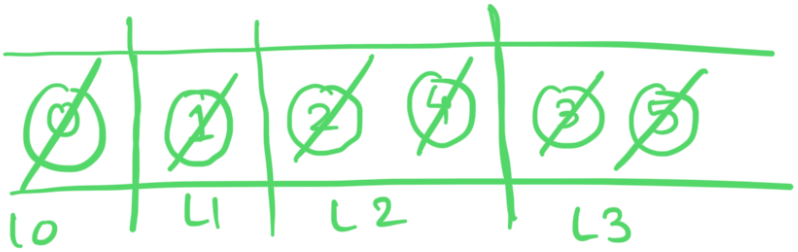


BFS / DFS.



farthNode = 5
distance = 3
(level)

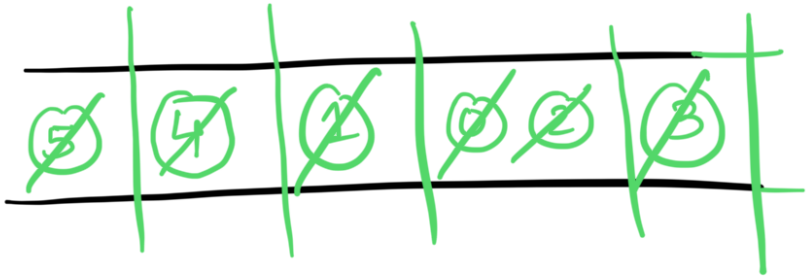
n = 2



Diameter का एक End = 5

farthestNode = 3

n = 1



Distance = 4

Diameter.

$$\begin{cases} T.C = O(V+E) \\ S.C = O(n) + O(V+E) \end{cases}$$

POTD

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