Diameter of a Graph (Connected Graph) ①

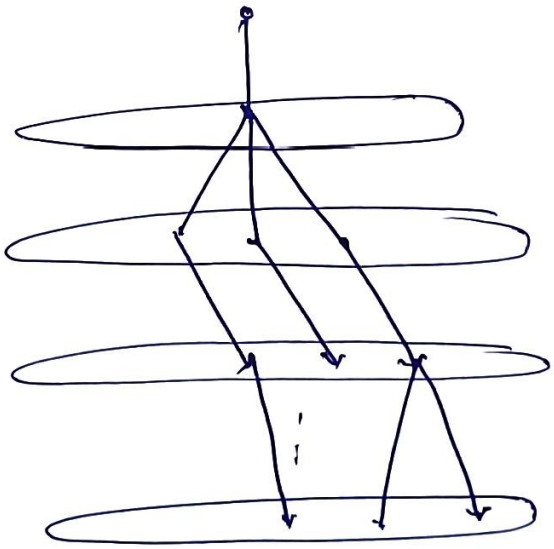
Length of the shortest path b/w two most distinct vertices.

$$\text{Diameter} = \max_{i\,j} \{ \delta(i,j) \}$$

$\delta(i,j)$ → shortest distance b/w i and j

Approach

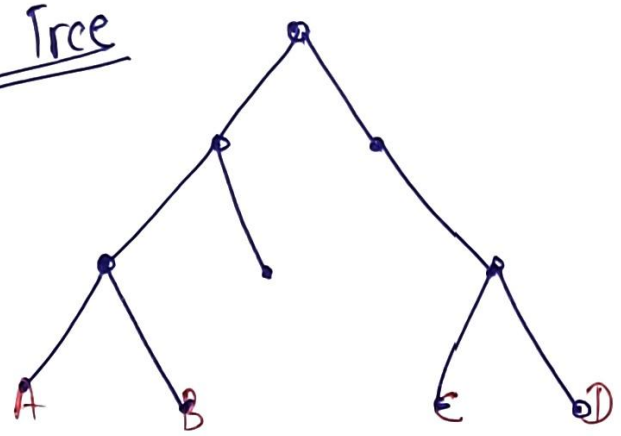
(i) Do a BFS



Let longest distance (d[]) is 4

Hence 4 is the diameter ?? No

BFS Tree



Diameter of this graph = 6

And we get this if BFS starts from

→ A
B
C
D

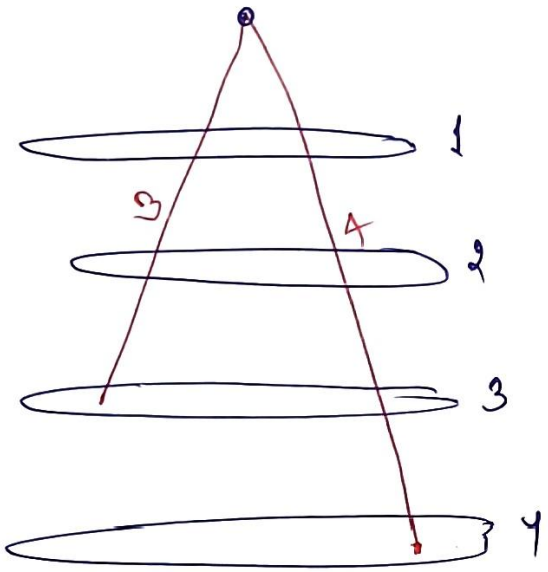
But we do not know from where to start so check BFS with each vertex and select

Max Distance

Time = $|V|(|V|+|E|)$

What we get if we do BFS from One Vertex Only

diameter(G) $\leq$ 2 * Maximum distance in **any** BFS



3+4 = 7 $\leq$ 8

No two vertices in this Example is 8 Unit Apart. WHY

* Pick any two vertices and see distance which is $\leq$ 8

Max. distance in any BFS $\leq$ Diam(G)

With one BFS, we get a range

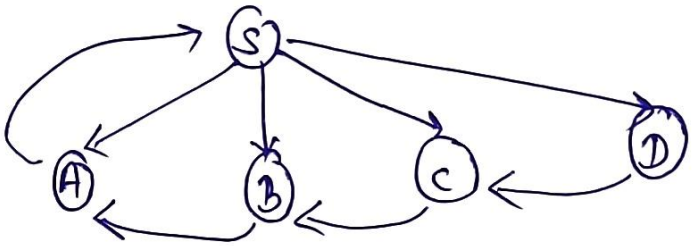
Max dis $\leq$ Dia(G) $\leq$ 2. Max dis

Is

(5)

diameter $< 2 * d$ True for Directed Graph ??

No



This is a connected graph.

* Consider S as Source node for BFS

BFS Tree

diameter $\leq 2 * 1$

dia ≤ 2 ✗

Why Diameter of this graph is 4

D → C → B → A → S