Quiz

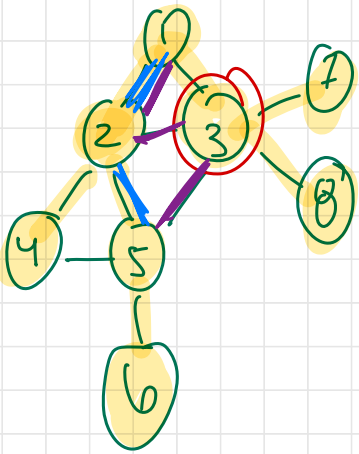
BFS trace w/ layers no PL

Topo sort PL

Pf by contradiction PL

some structure given

Graph Traversal

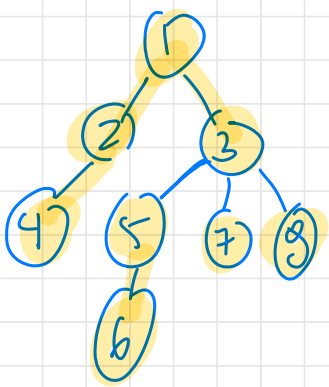


G, s = 1

u = 5

d(5) = 2

BFS Tree



$L_0 = \{1\}$

$L_1 = \{2, 3\}$

$L_2 = \{4, 5, 7, 8\}$

$L_3 = \{6\}$

Given G and s, unique layers

BFS tree may not be unique

Let d(u) be length of shortest path from s to node u.

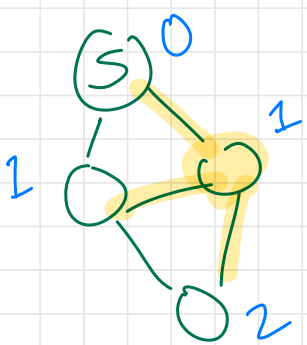
How do d(u) and u's layer L_i relate?

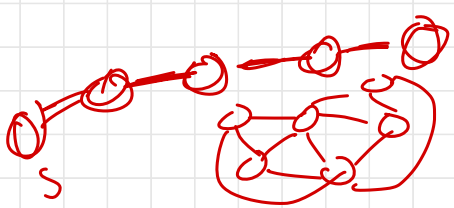
$d(u) = i$

BFS (G, s) G connected $|V| = n$, $|E| = m$

① Set all nodes' layer to null ←
Set s's layer to 0
Let $L = 0$ ← keep track of current layer

② while there is some node with null layer:
set layer of all nodes adjacent to a node in L to L+1 (if null)
$L = L + 1$





Finds nodes reachable from s.

Runtime? best vs worst

① depends on n Ω, O, Θ? $\Theta(n)$

(2) while loop

$O(n)$ # times loop runs

$m+n \in n$

$O(n)$ work in loop

m

n

$O(n^2)$

better

(1) $\Theta(n)$ ←

(2) overall while loops:

each node processed once

check all adjacent nodes

$deg(v)$

$\sum_{v \in V} deg(v) = 2m = \Theta(m)$ ←

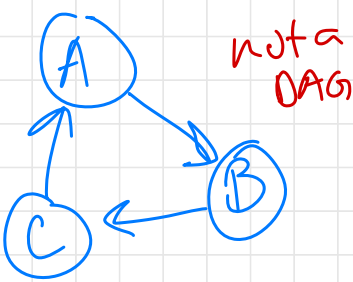
$\Theta(n+m)$

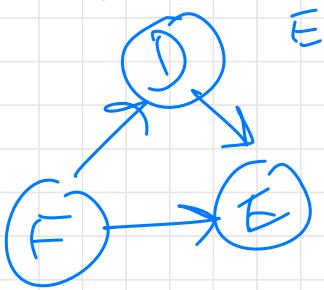
adj. matrix
$\Theta(n^2)$

adj lists
$\Theta(n+m)$

Directed Acyclic Graphs DAGs

A DAG is a directed graph that contains no directed cycles.





edges
$E = \{(F,D), (D,E), (F,E)\}$

A topological order of a directed graph is an ordering of the nodes $v_1, v_2, \ldots, v_n$ such that for every edge (v_i, v_j), $i < j$.

F, D, E
v_1 v_2 v_3

$F \to D$ (v_1 v_2) $1 < 2$ ✓

$D \to E$ (v_2 v_3) $2 < 3$ ✓

$F \to E$ (v_1 v_3) $1 < 3$ ✓