CSE 101 1-24-25

- Paz: ext. 1 more day

DFS: Depth First Search

Vertex attributes: $x \in V(G)$

- color[x]: white, gray, black
- $\pi[x]$: Parent/Predecessor
- d[x]: discover time
- f[x]: finish time

time $\in \{0, 1, \ldots, 2n\}$

where $n = |V(G)|$.

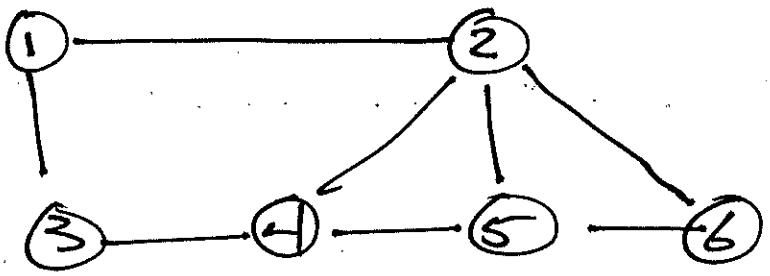
helper function: Visit(x)

→ see Pseudo-Code.

time

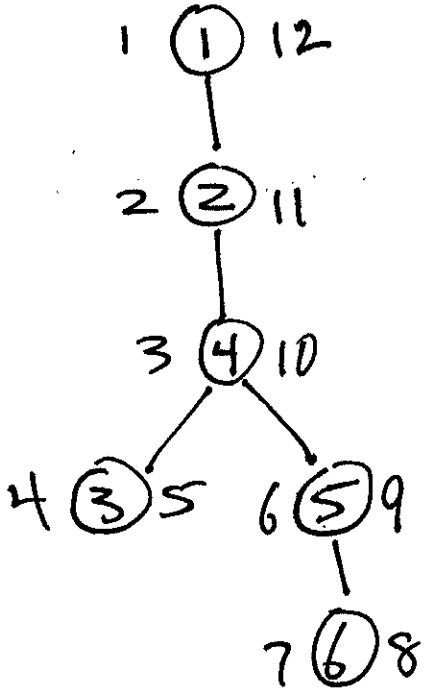
0 5 10
1 6 11
2 7 12
3 8
4 9

Ex.

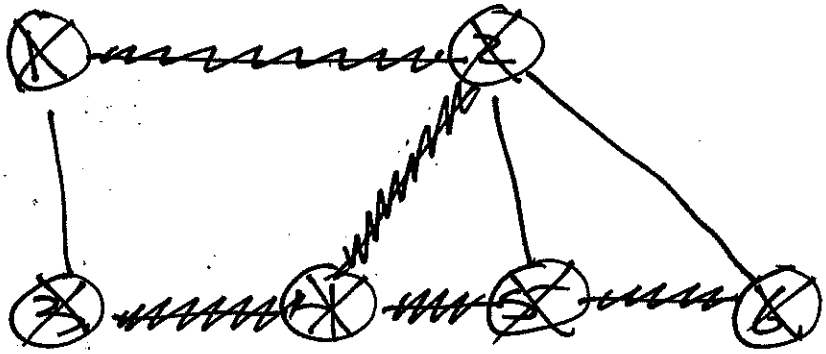


	adj	color	d	f	p
1	2 3	~~W~~ ~~G~~ b	1	12	n
2	1 4 5 6	~~W~~ ~~G~~ b	2	11	~~X~~ 1
3	1 4	~~W~~ ~~G~~ b	4	5	~~X~~ 4
4	2 3 5	~~W~~ ~~G~~ b	3	10	~~X~~ 2
5	2 4 6	~~W~~ ~~G~~ b	6	9	~~X~~ 4
6	2 5	~~W~~ ~~G~~ b	7	8	~~X~~ 5

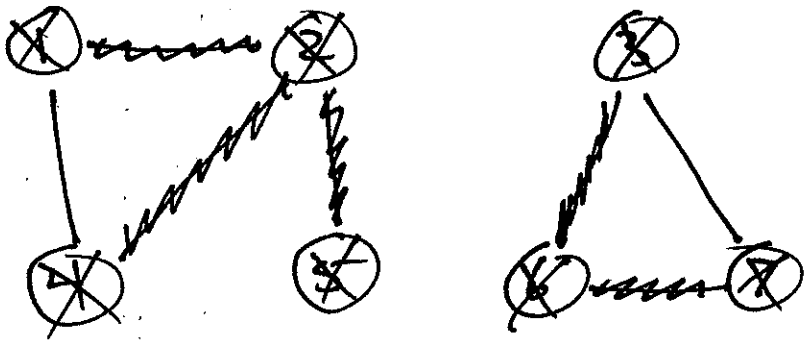
DFS Forest / Predecessor subgraph



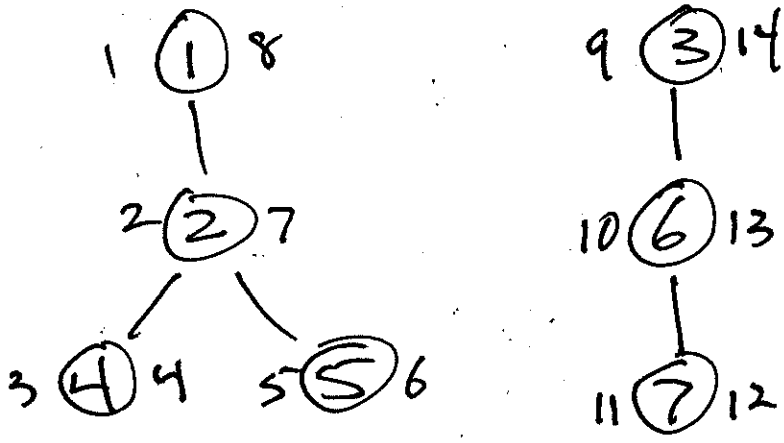
Again



Ex

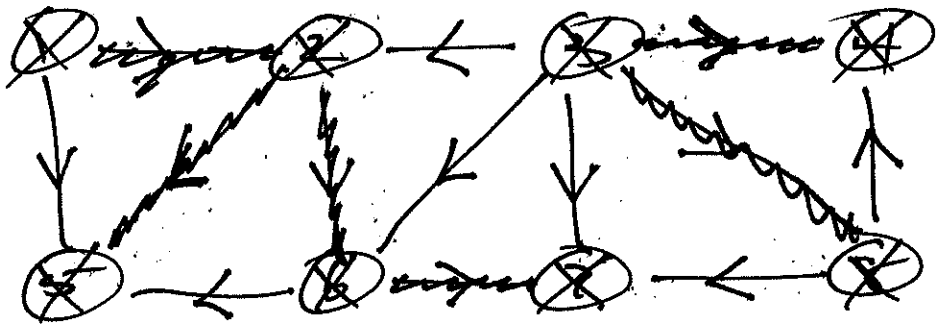


Forest

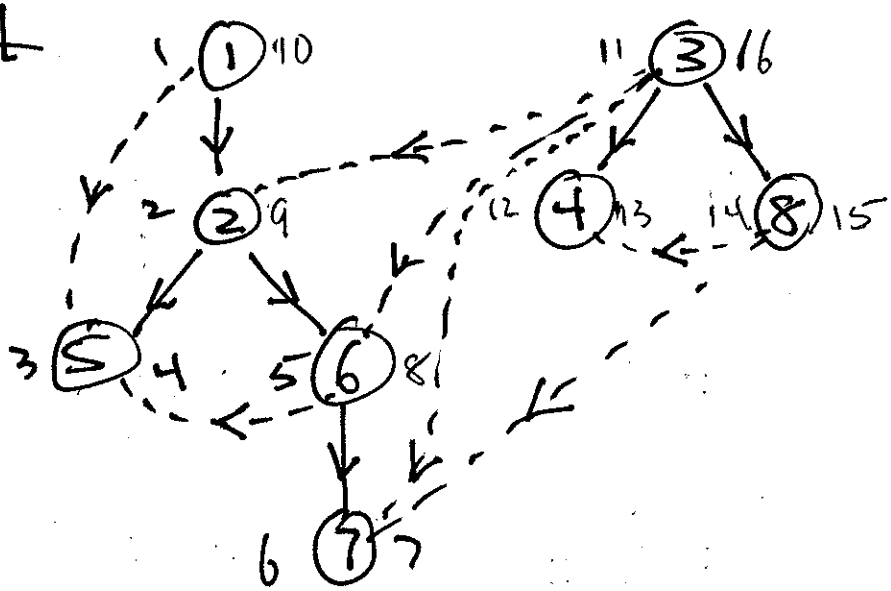


Thm if G is a graph (undirected) then # components of G = # trees in DFS-forest after DFS(G)

Ex.



Forest



Defn Predecessor subgraph: $G_p = (V_p, E_p)$

$$V_p = V(G)$$

$$E_p = \{ (P[x], x) \mid P[x] \neq nil \}$$

ordered pair: digraph

unordered pair: graph.

classification of Edges

- Tree edges: belong to DFS Forest.
- Back edges: Join x to an ancestor
- Forward edges: Join x to a descendant (other than a child)
- Cross edges: all else
  - cousin to cousin
  - tree to tree