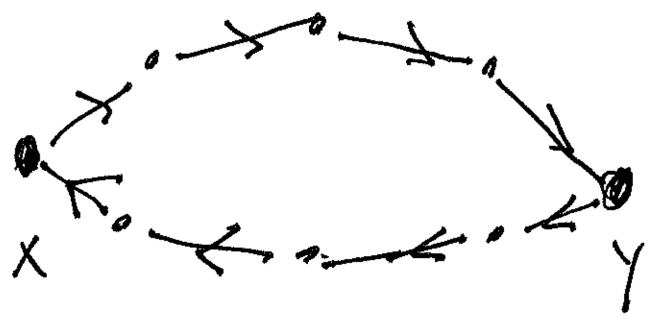
cse 101-02 4-12-22

Paz: ext. 2 days

Let G be a digraph. We say $y \in V(G)$ is <u>reachable</u> from $x \in V(G)$ iff G contains a directed x-y path.

A digraph G is called <u>strongly connected</u> iff for all $x, y \in V(G)$ y is reachable from x (and x from y.)



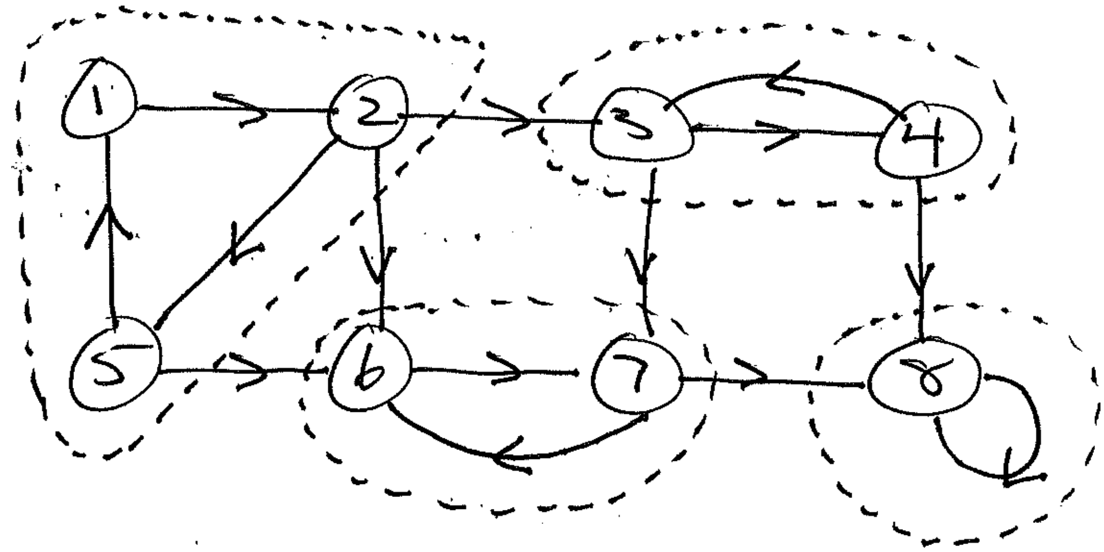
Also $S \subseteq V(G)$ is called <u>strongly connected</u> iff for all $x, y \in S$ y is reachable from x (and x from y.)

Also $S \subseteq V(G)$ is called a <u>strongly connected component</u> of G (SCC) iff

(i) S is strongly connected, and

(ii) S is maximal w.r.t (i)

Ex.



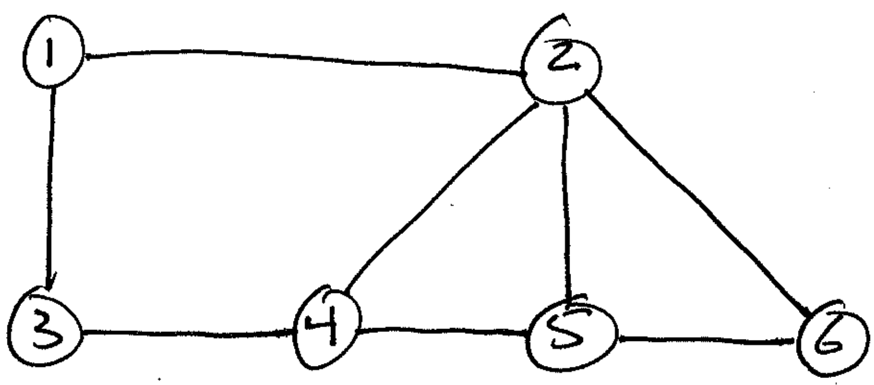
Depth First Search (DFS)

each $x \in V(G)$ has attributes:

- color[x] : white, gray, black
- p[x] : Parent or Predecessor
- d[x] : discover time stamp
- f[x] : finish " "

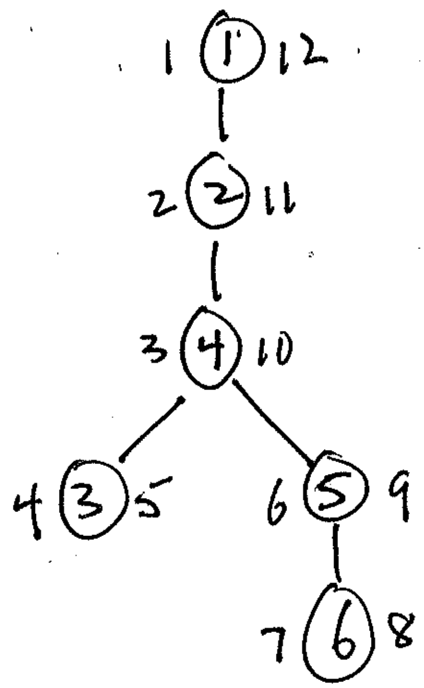
- Recursive helper fcn: Visit(x)
- local variable time in DFS(), static over all recursive calls to visit.

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	~~n~~ 1
✓	3	~~1~~ ~~4~~	~~w~~ ~~g~~ b	4	5	~~n~~ 4
✓	4	~~2~~ ~~3~~ ~~5~~	~~w~~ ~~g~~ b	3	10	~~n~~ 2
✓	5	~~2~~ ~~4~~ ~~6~~	~~w~~ ~~g~~ b	6	9	~~n~~ 4
✓	6	~~2~~ ~~5~~	~~w~~ ~~g~~ b	7	8	~~n~~ 5

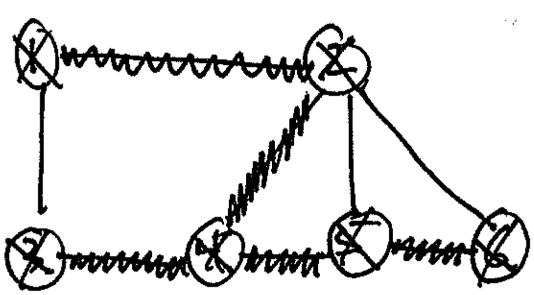
Forrest

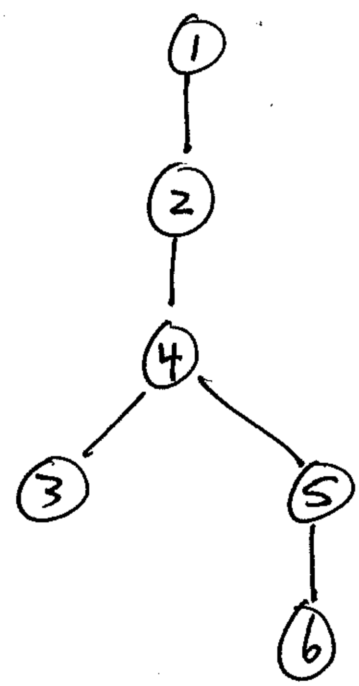


time

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

Quick Way:



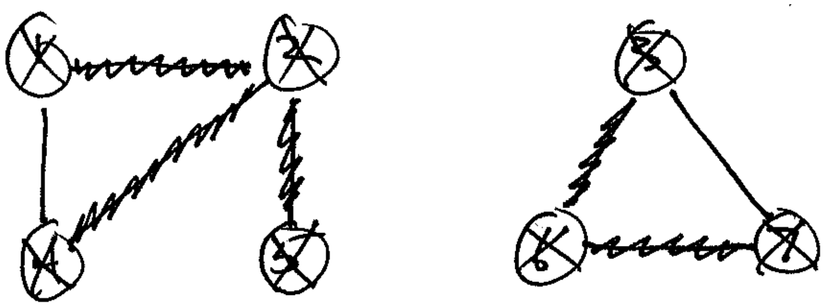


Predecessor subgraph: $G_p = (V_p, E_p)$

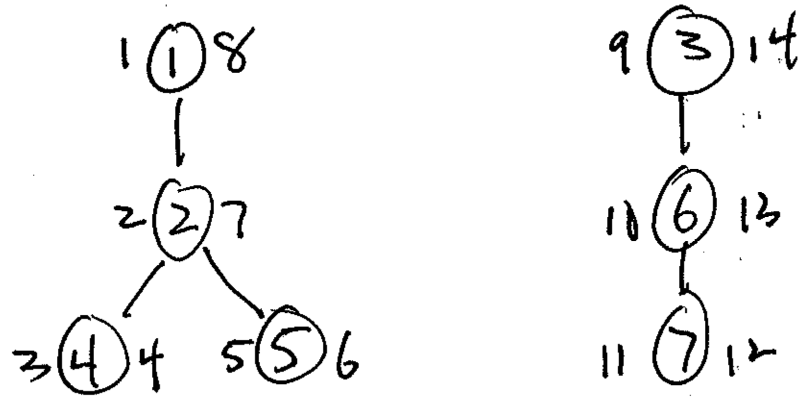
$$V_p = V(G)$$

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

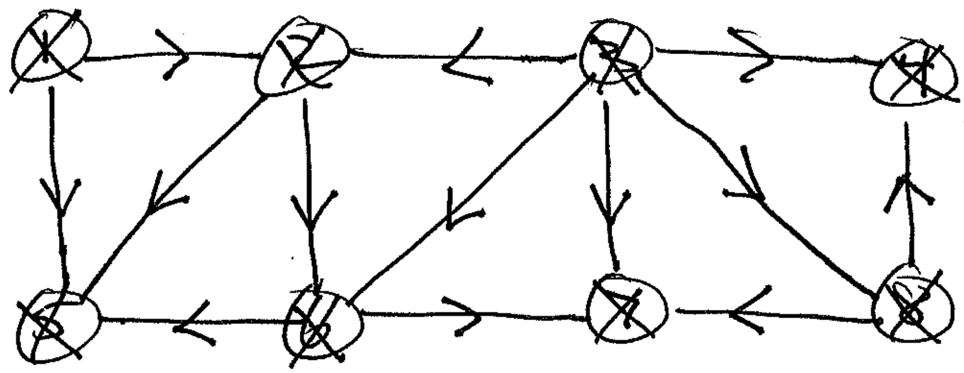
Ex.



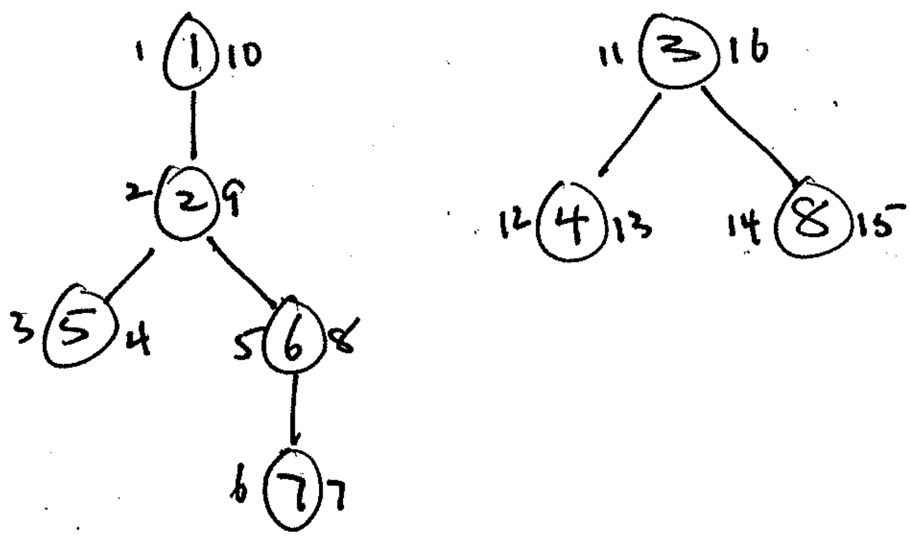
forest:



Ex.



forest:



Parenthesis string:

"(" = discover
")" = finish

time: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

string: ((( ) (( )))) (( ) ( ))