CSE 101-02 4-12-22

- pa2 : ext. 2 days

Questions: addEdge() vs. addArc()

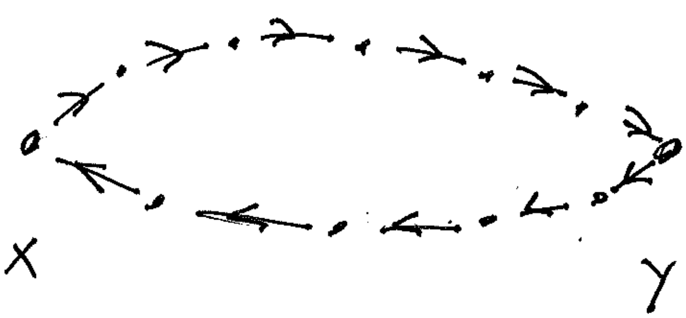
- pa3 is posted.

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.

<u>Defn</u>

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



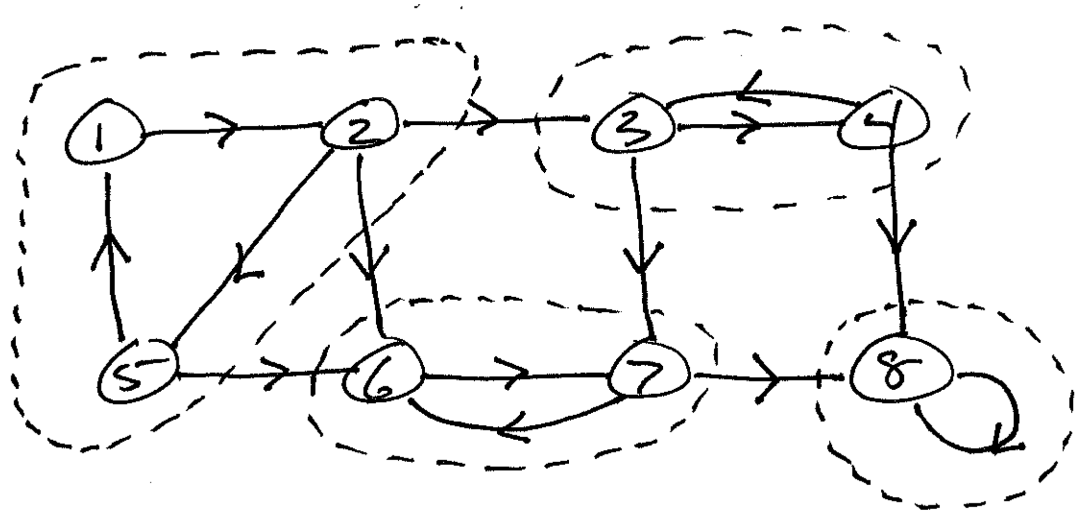
Also $S \subseteq V(G)$ is called <u>strongly connected</u> iff for all $x, y \in S$ x is reachable from y, and y from x.

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

(i) S is strongly connected, and

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

<u>Ex.</u>



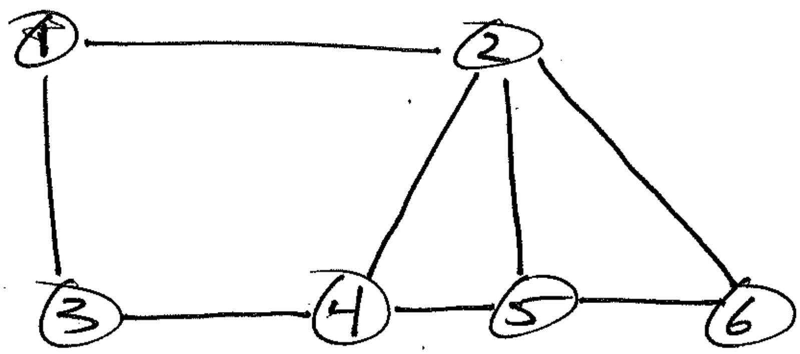
Depth First Search (DFS)

each vertex $x \in V$ has attributes

- color[x] : white, gray, black
- P[x] : Parent (Predecessor) of x.
- d[x] : discover time of x
- f[x] : finish time of x.

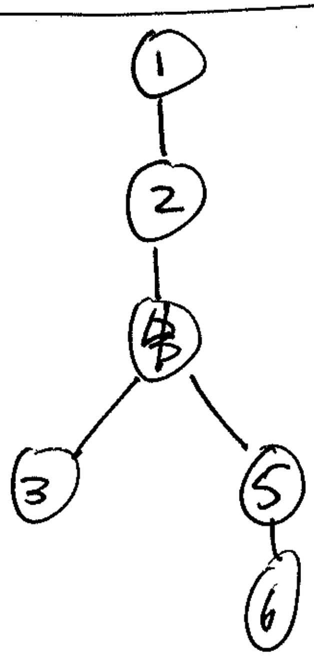
- recursive Part : Visit(x)
- DFS has a variable called time static over all calls to Visit.

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

DFS Forest

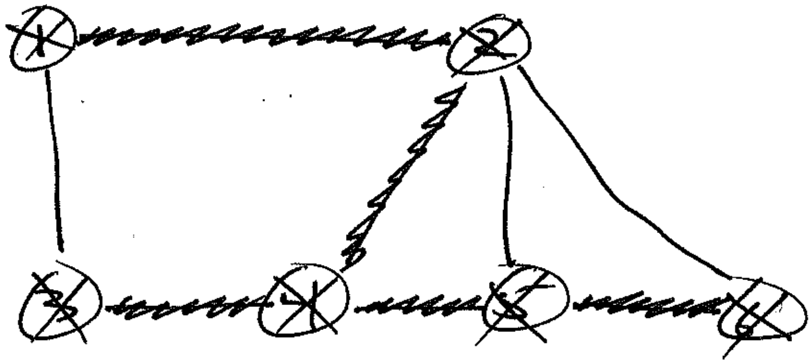


time

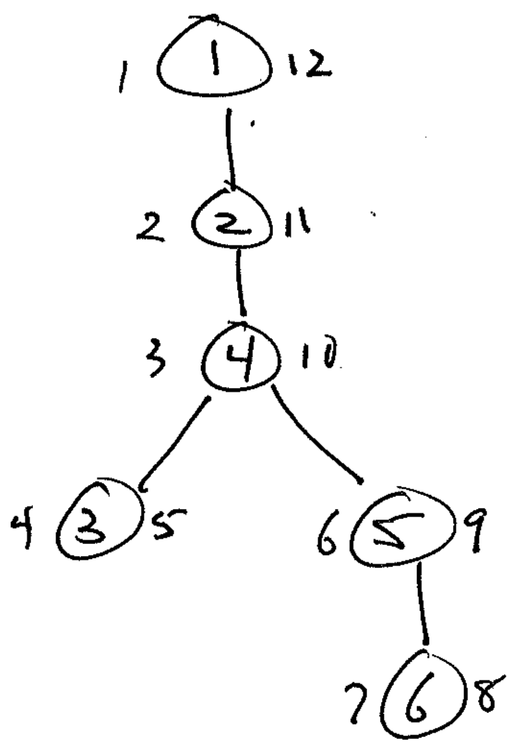
~~0~~ ~~1~~ ~~2~~ ~~3~~ ~~4~~ ~~5~~ ~~6~~ ~~7~~ ~~8~~ ~~9~~ ~~10~~ ~~11~~ 12

Quick way!

Ex.



DFS Forest!

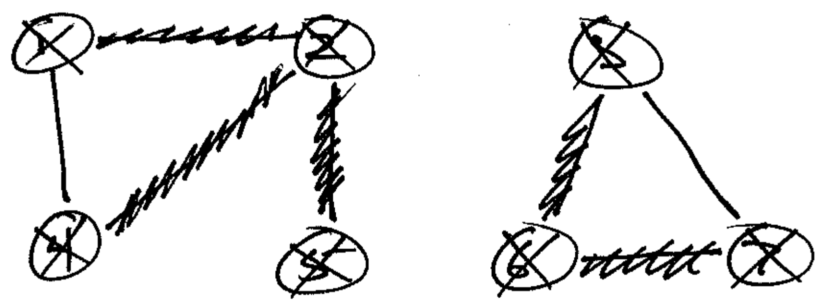


Predecessor subgraph $G_p = (V_p, E_p)$

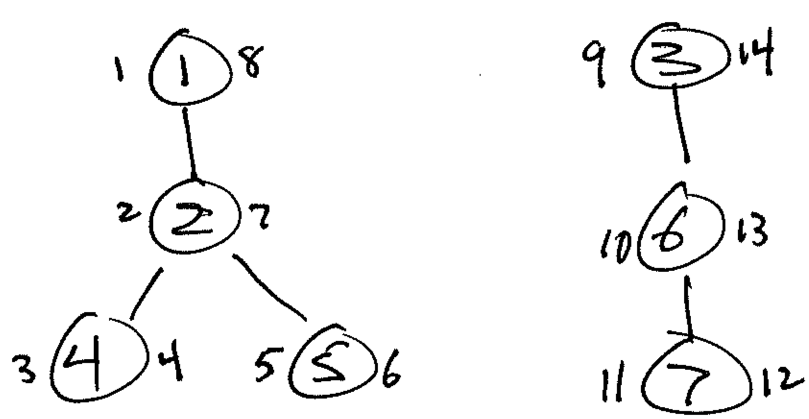
$$V_p = V(G)$$

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

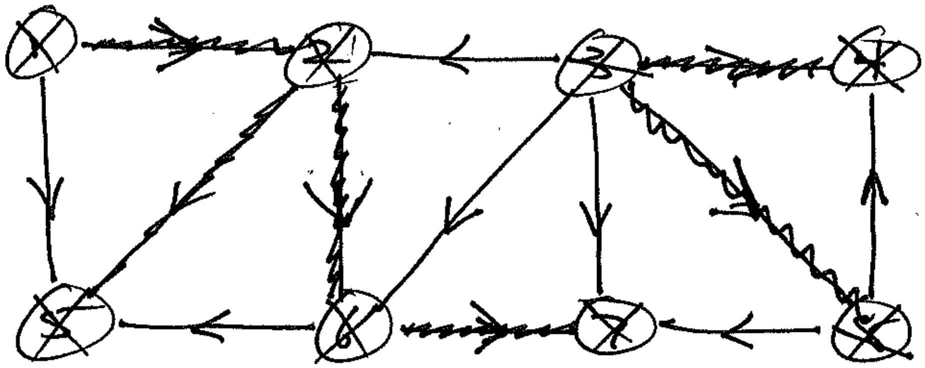
Ex.



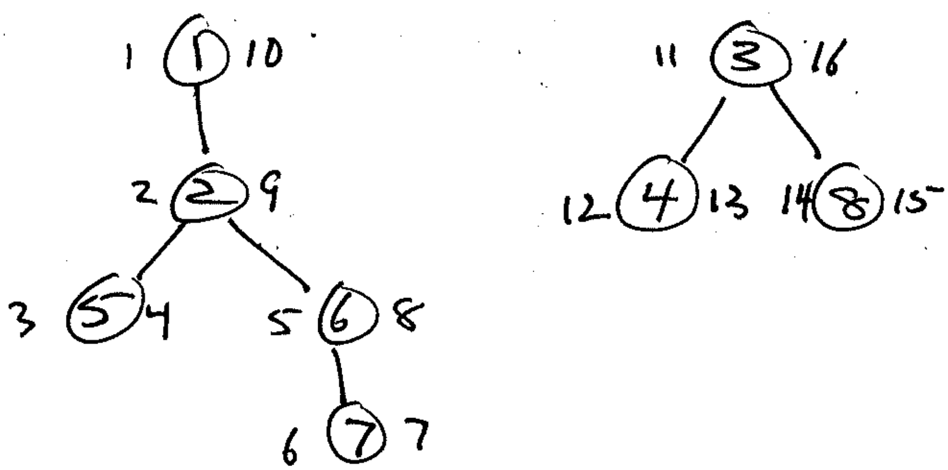
DFS Forest



Ex.



Forest:



Parenthesis string:

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