$$n = 5$$
$$m = 4$$

If $u \in L_i \implies \exists$ path $s \rightsquigarrow u$

$$L_0 \qquad L_2 \qquad \qquad L_{i-1} \qquad L_i$$

If $\exists$ path $s \rightsquigarrow u$

$\implies u \in L_i$ for some i

Space complexity of Adj List

$$\sum_{u \in V} (|N(u)| + 1) = \left(\sum_{u \in V} |N(u)| \right) + |V|$$

$$= 2|E| + |V|$$
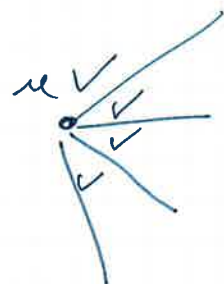
	a	b	c	d
visited	~~F~~ T	~~F~~ T	F	~~F~~ T
parent	~~None~~ None	~~None~~ a	~~None~~ b	~~None~~ b
discovery	1	2	5	3
finish	8	7	6	4

DFS - visit (a)

time = 1
~~discove~~
parent [b] = a
DFS—visit (b)

    time = 2
    parent [d] = b
    DFS - visit (d)

        time = 3
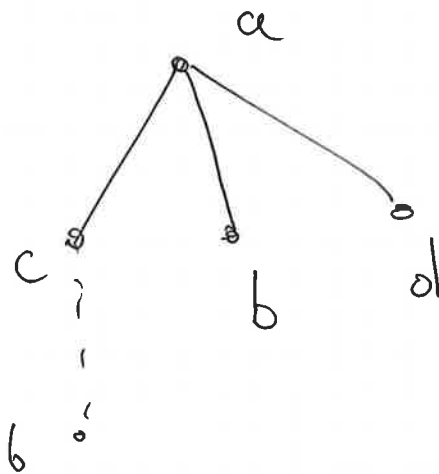   time = 4

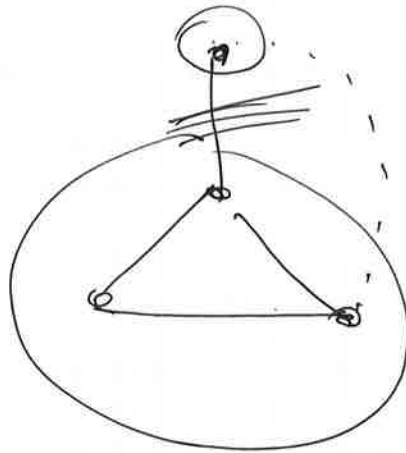   parent [c] = b
    DFS—visit (c)

        time = 5
        time = 6

time = 2

time = 0
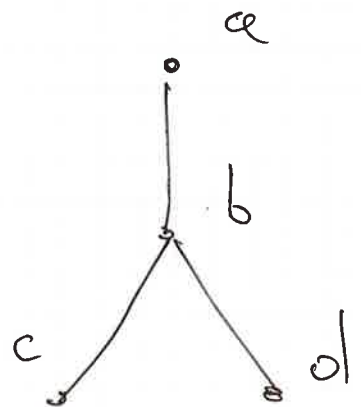
Would it be possible ?

a

c   b   d

6

$$\left\{ (u, parent[u]) : \underset{parent[u] \neq None}{\forall u \in V} \right\}$$

DFS FOREST

μ is root of DFS

μ is cut vertex $\iff$ μ has 2 or more children

μ is a leaf of DFS tree
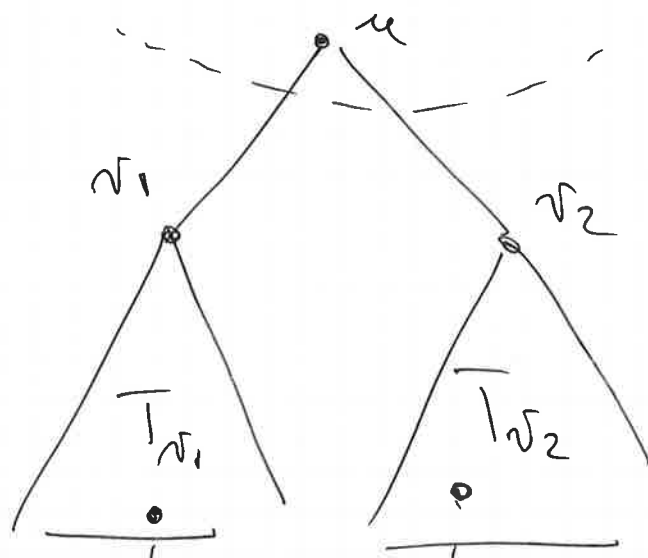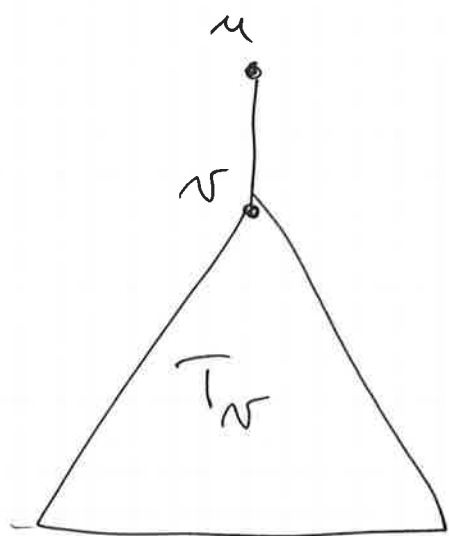
$T_v - \mu$ is connected

is not a back edge $\Rightarrow \nexists$
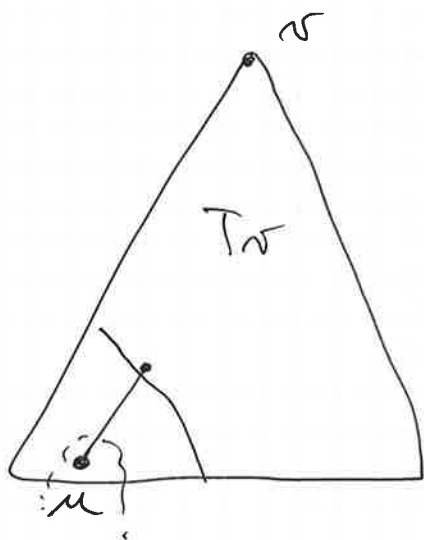
u is internal vertex of DFS tree

root

v_1 v_2 v_3

T_{v_1}

u

v
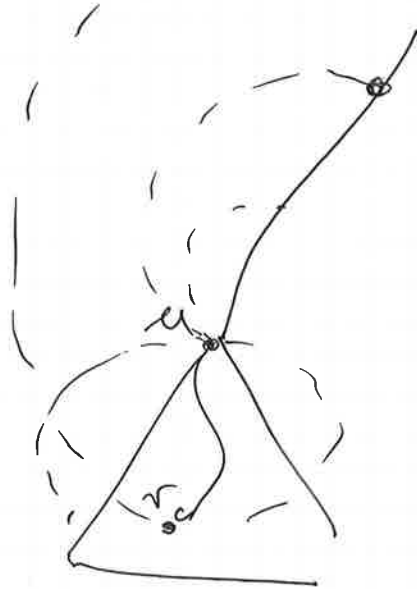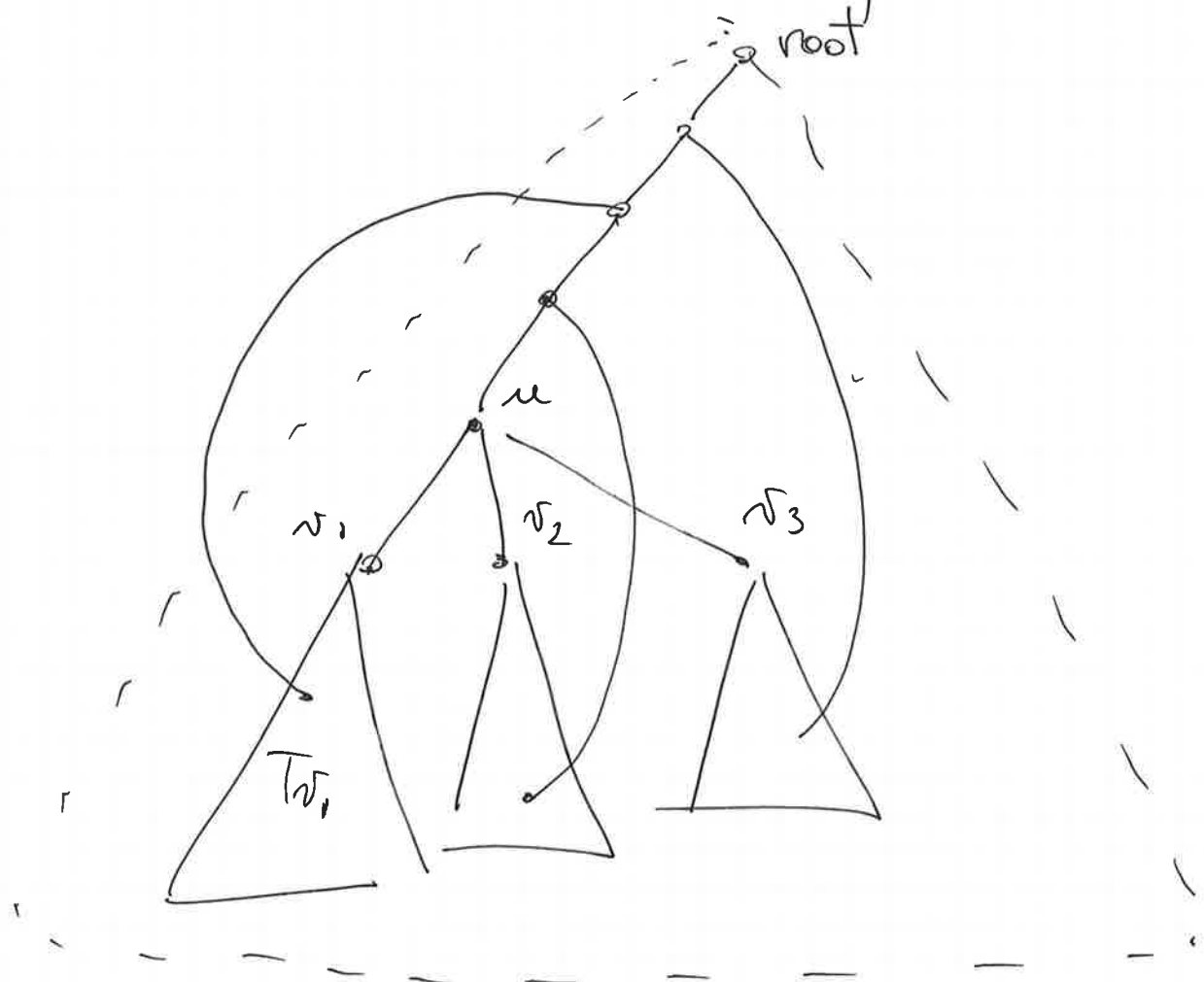
$$up[u] = \min_{v \in N(u)} disc[v]$$
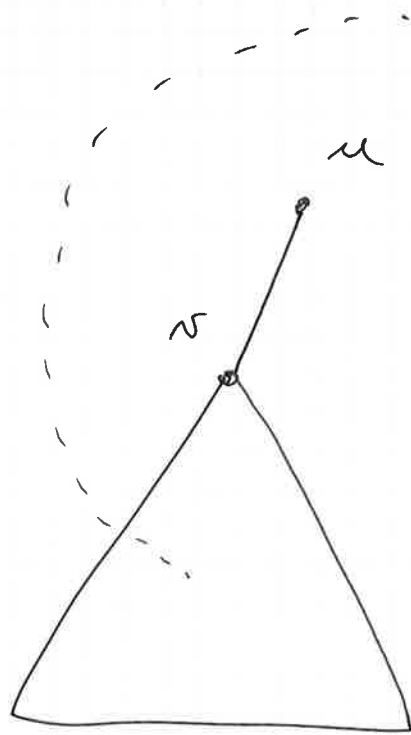
discovery

$$\text{down-}\&\text{-up}[v] \overset{\vee}{\leq} d[u]$$

Complexity of computing $up[\cdot]$
is $\Theta(m)$ time

Complexity of computing $d\text{-}\&\text{-}u[u]$
is $O(n)$ time

Comp of computing $d\text{-}\&\text{-}u[\cdot]$
is $O(n^2)$ time