$v_1 \circ \!\!-\!\!\! \circ v_2 \quad v_3 \qquad \cdots \quad v_{m} \quad v_k$
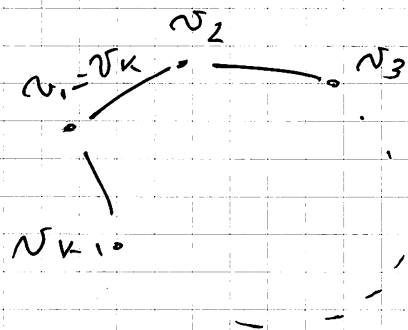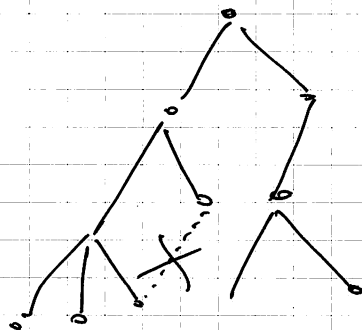
$v_1 - v_k$ path

length = # edges = $k-1$

cycle of length = k
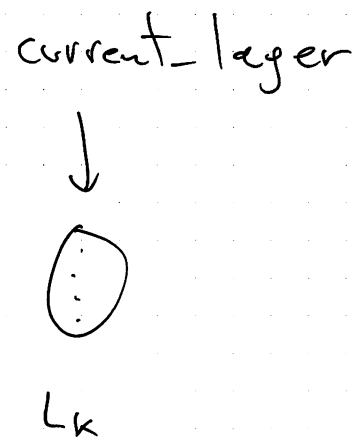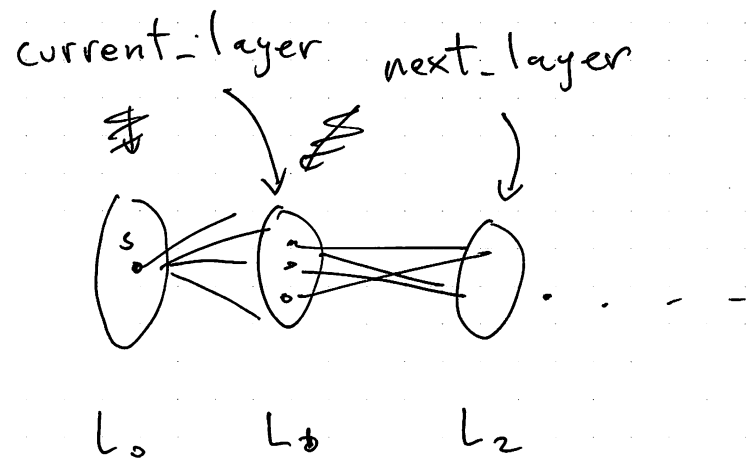
$v_1 = v_k \quad v_2 \quad v_3$

v_{k-1}

tree

current_layer   next_layer   current_layer

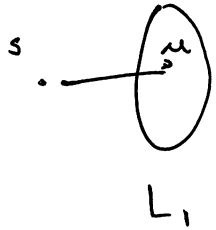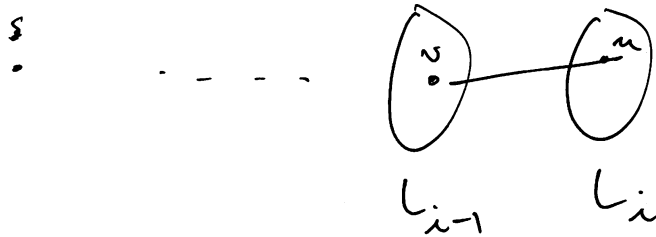L_0 L_1 L_2 L_k

layers = $[L_0, L_1$

$i=1$

$s \cdot \overrightarrow{\quad} \underset{\mu}{\bigcirc} L_1$ ✓

$i > 1$

$s \cdot \quad - \ - \ - \quad \underset{v}{\bigcirc} \overrightarrow{\quad} \underset{\mu}{\bigcirc}$

$L_{i-1} \quad L_i$

$i=1$

$\underset{s}{\cdot} \overline{\quad} \underset{\mu}{\cdot} \quad \Rightarrow \quad \mu \in L_i$

i

$\underset{s}{\cdot} - - - - \underset{v}{\cdot} \overline{\quad} \underset{\mu}{\cdot} \quad \Rightarrow \quad N \in L_j \quad (IH)$

$\Rightarrow \mu \in L_i$

$s \cdot \quad \underset{u}{\bigcirc} \quad \bigcirc \quad \underset{v}{\bigcirc} \quad \cdots \cdots \quad \bigcirc$

$L_1 \qquad L_2 \quad L_3 \qquad\qquad L_k$

Obs : Let $G = (V, E)$ be a graph

$$\sum_{\mu \in V} |N(\mu)| = 2|E|$$

μ

$\mu \quad \checkmark \qquad \checkmark N$
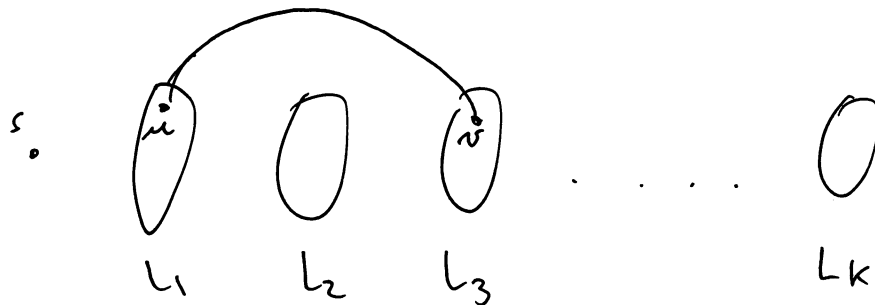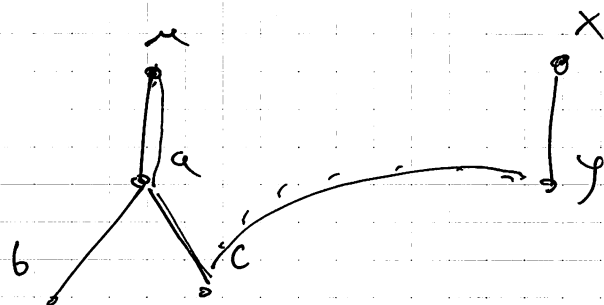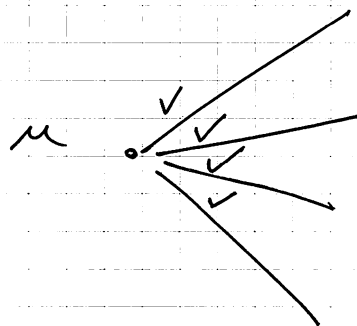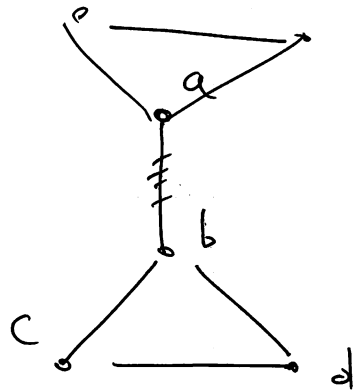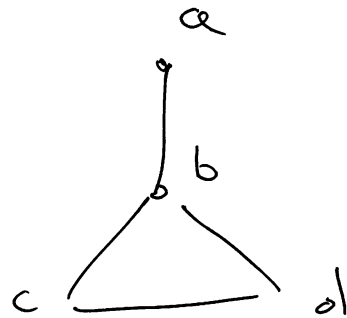
DFS tree

Cut edges

Is (c, b) a cut edge? No

Is (a, b) a cut edge? Yes

Algorithm for finding cut edges in a given $G = (V, E)$
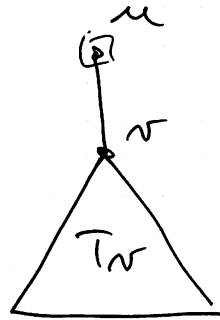
Cut vertex

Is b cut vertex? Yes

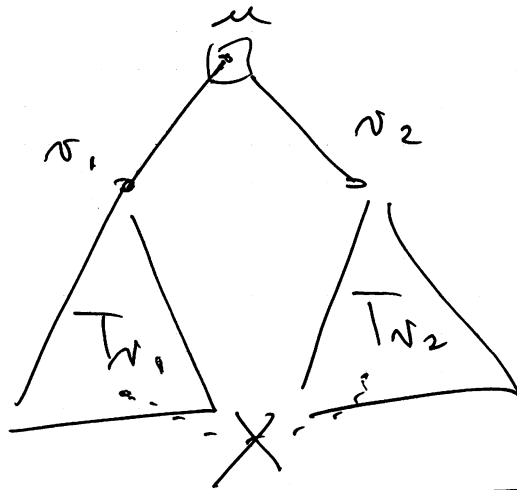Is a cut vertex? No

when u is root of DFS tree

CASE ①

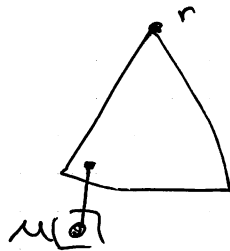$\Rightarrow$ u is not cut vertex

CASE ②

$\Rightarrow$ u is cut vertex

when u is a leaf of DFS tree

when u is an internal vertex of DFS tree