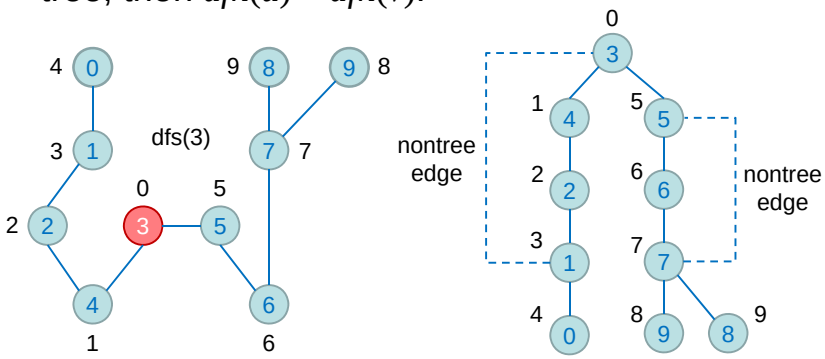
Find Biconnected Components (2/4)

- If u is an ancestor of v in the depth first spanning tree, then $dfn(u) < dfn(v)$.



Find Biconnected Components (3/4)

- A nontree edge (u, v) is a back edge iff either u is an ancestor of v or v is an ancestor of u.

➡ From the definition of depth first search, all nontree edges are back edges.

➡ The root of a depth first spanning tree is an articulation point iff it has at least two children.

➡ Any other vertex u is an articulation point iff it has at least one child w such that we cannot reach an ancestor of u using a path that consists of only w, descendants of w, and a single back edge.

Find Biconnected Components (4/4)

- $low(u)$ is the lowest depth first number that we can reach from u using a path descendants followed by at most one back edge:

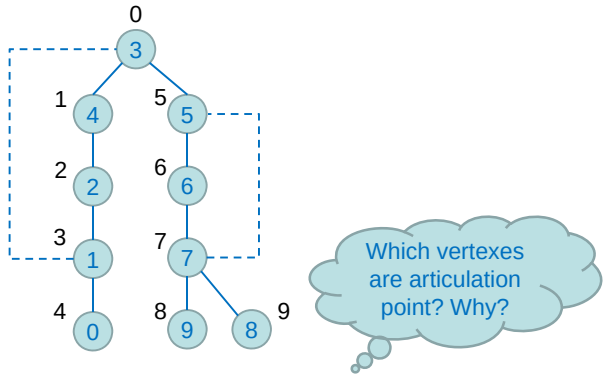
$$low(u) = \min\{dfn(u), \min\{low(w) \mid w \text{ is a child of } u\}, \min\{dfn(w) \mid (u, w) \text{ is a back edge}\}\}$$

➡ We can say that u is an articulation point iff

(1) u is either the root of the spanning tree and has two or more children, or

(2) u is not the root and u has a child w such that $low(w) \geq dfn(u)$.

dfn and low (1/2)



Vertex	0	1	2	3	4	5	6	7	8	9
dfn	4	3	2	0	1	5	6	7	9	8
low										