

9.

- a. Run a Depth-First Search algorithm on some node that need not be a root with runtime  $O(|V| + |E|)$ . If there is more than one tree in the DFS forest, this must mean that there is a particular intersection that we cannot reach from some point on a different tree using only one-way streets.
- b. Run a DFS with runtime  $O(|V| + |E|)$  starting on the node with the smallest in-degree (if possible)  
If all nodes are connected by tree edges, then the root of the tree is privileged  
If there is a back edge from a node to the root, then all of the nodes including and above that node will also be privileged
- c. First, compute  $G^T$   
Then, call  $\text{DFS}(G^T)$ , and order the nodes  $1, \dots, n$  in order of decreasing finishing time (as in  $\text{DFSTopSort}$ )  
Lastly, call  $\text{DFS}(G)$  — but in the top-level loop, process in the order  $1, \dots, n$   
The result will be all the safe spaces or Strongly Connected Components  
This will run in time  $O(|V| + |E|)$ .