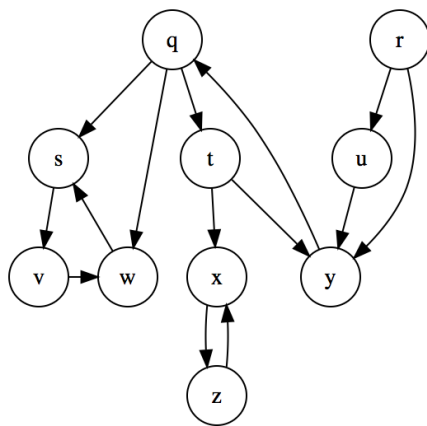


Algorithm HW9

1. A DFS forest can be generated by perform DFS on a directed graph. There are 4 types of edges in a DFS forest: tree edge, forward edge, back edge and cross edge. Modify DFS so that it can determine the type of each edge.

2. Exercise 22.5-2

Show how the procedure STRONGLY-CONNECTED-COMPONENTS works on the graph of Figure 22.6. Specifically, show the finishing times computed in line 1 and the forest produced in line 3. Assume that the loop of lines 5-7 of DFS considers vertices in alphabetical order and that the adjacency lists are in alphabetical order.



3. Exercise 22.5-7

A directed graph $G = (V, E)$ is **semiconnected** if, for all pairs of vertices $u, v \in V$, we have $u \rightsquigarrow v$ or $v \rightsquigarrow u$. Give an efficient algorithm to determine whether or not G is semiconnected. Prove that your algorithm is correct, and analyze its running time.

4. 在投影片 Unit 7 P.39 的地方有提到另一個 DFS 的實作，但其輸出的 order 可能會不同，試問該 DFS 的實作是否可以用來解 Topological Sorting 以及 Strongly-Connected-Components?

5. Exercise 23.1-3

Show that if an edge (u, v) is contained in some minimum spanning tree, then it is a light edge crossing some cut of the graph.

6. Exercise 23.1-5

Let e be a maximum-weight edge on some cycle of connected graph $G = (V, E)$. Prove that there is a minimum spanning tree of $G' = (V, E - \{e\})$ that is also a minimum spanning tree of G . That is, there is a minimum spanning tree of G that does not include e .

7. Exercises 23.1-6:

Show that a graph has a unique minimum spanning tree if, for every cut of the graph, there is a unique light edge crossing the cut. Show that the converse is not true by giving a counterexample.