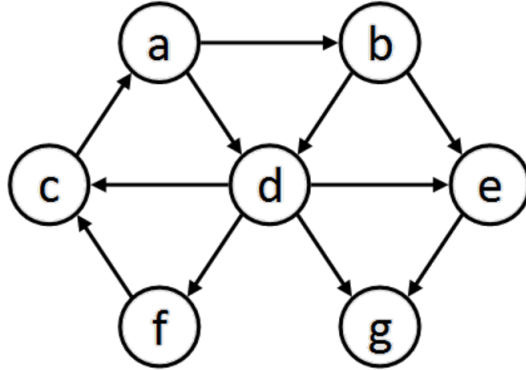


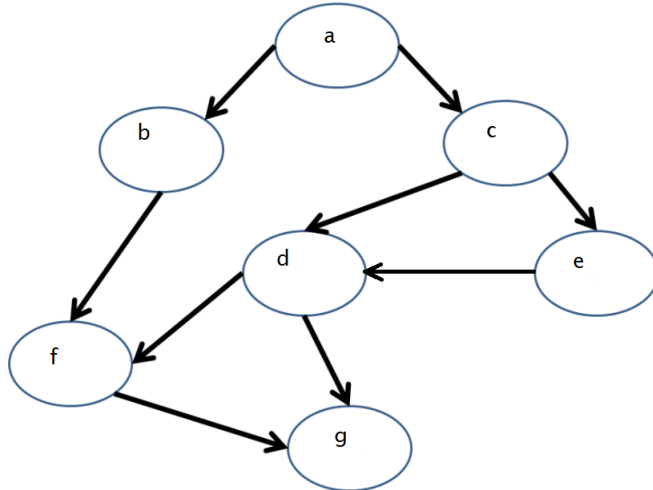
Algorithms - CS5800 - Summer 2, 2017 - Assignment 4

1. Use the DFS algorithm to find the strongly connected components of the following graph:



(Explain the steps of your work)

2. Use the DFS algorithm to find a topological sorting of the following graph:



(Explain the steps of your work)

3. Let $G = (V, E)$ be an undirected connected graph. Describe an algorithm that finds a path p that uses each edge $e \in E$ exactly twice.
4. Let $G = (V, E)$ be a directed graph. We say that $v_0 \in V$ is a root if for any vertex $u \in V$ there exists a path $v_0 \rightsquigarrow u$ in G .

We denote:

$$R_G = \{v \in V \mid v \text{ is root in } G\}.$$

Show that for any possible DFS run on the graph G , the set R_G is in the same DFS-forest component.

5. This question is optional.
Let $G = (V, E)$ be a directed graph.

- (a) Let $v_0 \in V$ and $u \in V$ be two different vertices in V . Find an algorithm that determines if there exists a path from v_0 to u that contains a cycle.
- (b) Let $v_0 \in V$ and let $U \subseteq V$. Use the algorithm from part (a) to give an algorithm that determines for each vertex $u \in U$, if exists a path from v_0 to u that contains a cycle.