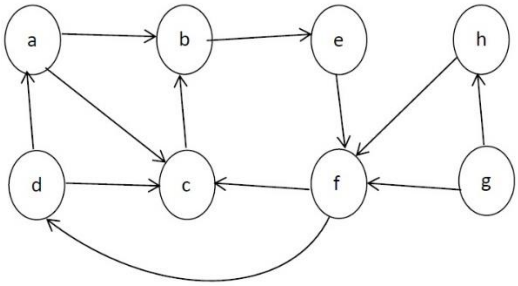
Algorithm Quiz2

1. (25%)

G :



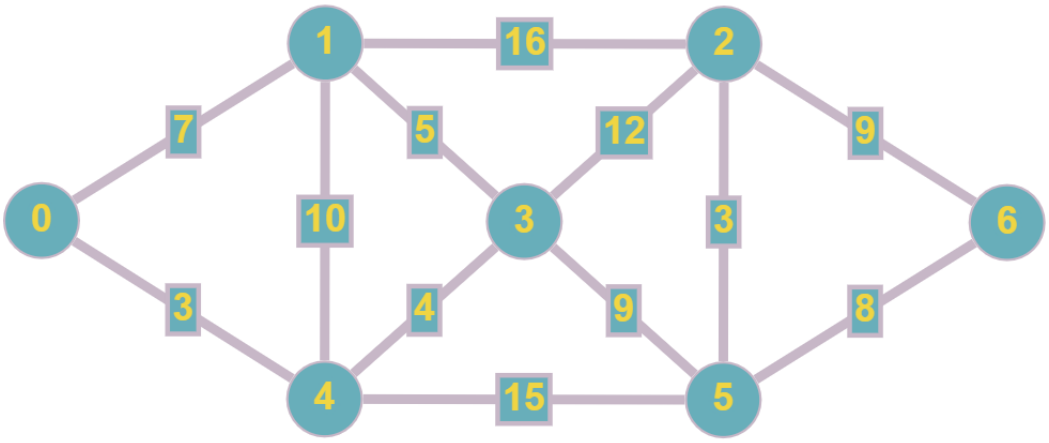
Given above graph $G = (V, E)$, please answer the following questions:

(a) Draw the adjacency matrix and adjacency lists for graph G.

(b) Use DFS (Depth first search) to find all vertices by starting from vertex a. If there are at least 2 edges to go, please choose the vertex in alphabet order. For instance, vertex a can go to vertex b or vertex d, choose vertex b instead of vertex d. (You need to write discovery and finish time for each vertex, and mark T (tree edge), B (back edge), F (forward edge) and C (cross edge) for all edges.)

(c) Analyze and give the time complexity (θ) for DFS algorithm.

2. (25%)



Find Minimum Spanning Trees by

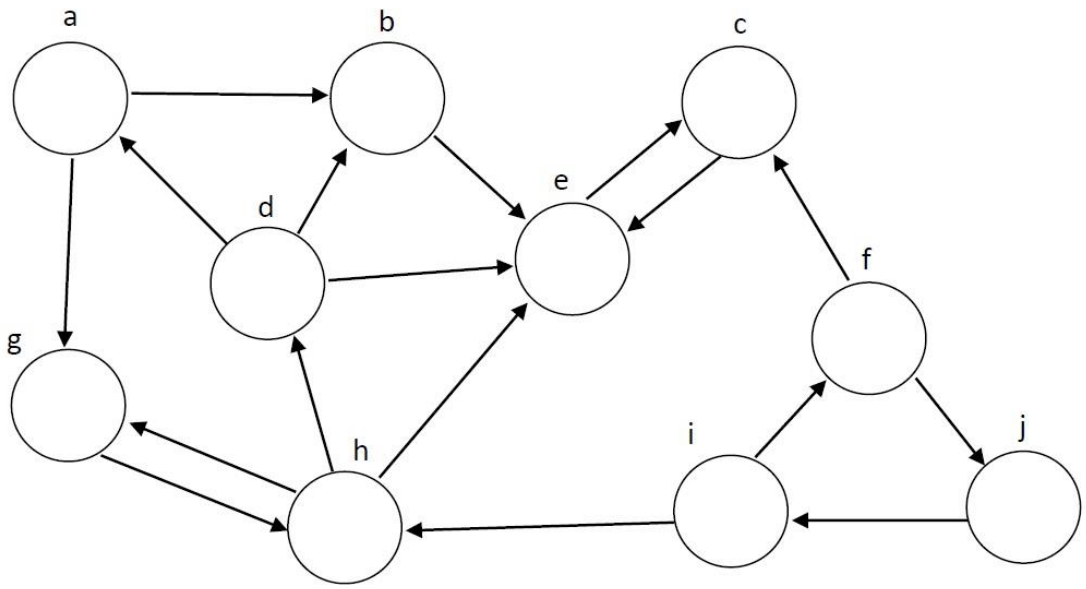
(Write down the process)

(a) Kruskal's algorithm

(b) Prim's algorithm (start at 0)

3. (25%)

(a) Find the strongly connected components.



(b) Show the component graph of the previous graph.

(c) Explain why the component graph must be a DAG (directed acyclic graph).

4. (25%)

You are given a set S of n overlapping arcs of the unit circle. The arcs can be of different lengths. Please build an algorithm to find a largest subset P of these arcs such that no two arcs in P overlap (largest in terms of total number of elements, not in terms of total length of these arcs). Prove that your solution is optimal.