# CSC 225 Spring 2016
# ALGORITHMS AND DATA STRUCTURES I
# ASSIGNMENT 4
# UNIVERSITY OF VICTORIA

1. Let $G$ be a graph whose vertices are integers 1 through 8, and let the adjacent vertices of each vertex be given by the table below:

| vertex | Adjacent vertices |
|---|---|
| 1 | $(2, 3, 4)$ |
| 2 | $(1, 3, 4)$ |
| 3 | $(1, 2, 4)$ |
| 4 | $(1, 2, 3, 6)$ |
| 5 | $(6, 7, 8)$ |
| 6 | $(4, 5, 7)$ |
| 7 | $(5, 6, 8)$ |
| 8 | $(5, 7)$ |

   Assume that, in a traversal of $G$, the adjacent vertices of a given vertex are returned in the same order as they are listed in the above table.

   (a) Draw $G$

   (b) Order the vertices as they are visited in a DFS traversal starting at vertex 1.

   (c) Order the vertices as they are visited in a BFS traversal starting at vertex 1.

2. For the graph $G$ in Problem 1, draw its adjacency-lists representation and adjacency matrix representation.

3. Show that every connected graph has a vertex whose removal (including all adjacent edges) will not disconnect the graph and design a DFS-based algorithm that finds such a vertex.

4. Let $F = (V, E)$ be a forest with $n$ vertices and $k$ connected components. Prove that the number of edges in $F = n - k$.

5. Design an algorithm to determine whether a digraph has a unique topological ordering.