Comp 4433 Assignment 4

Each student is required to do this assignment individually and to hand in the answer sheet through D2L on the due date. You may use Microsoft Word or other software to type out your answer. The solutions should be neat and easy to read.

The score of the assignment will depend on:

Specification and documentation: 20 %
Correctness: 80 %

Late assignments will be penalized (-10% with 1-day delay; -20% with 2-day delay and -30% with 3-day delay) and will not be accepted after 3 days.

Problem 1.

The BFS procedure is as follows.

```
BFS(G, s)
1:      for each vertex u ∈ G.V − {s} do
2:              u.color = WHITE
3:              u.d = ∞
4:              u.π = NIL
5:      s.color = GRAY
6:      s.d = 0
7:      s.π = NIL
8:      Q = ∅
9:      Enqueue(Q, s)
10:     while Q <> ∅ do
11:             u =Dequeue(Q)
12:             for each v ∈ G.adj[u] do
13:                     if v.color == WHITE then
14:                             v.color = GRAY
15:                             v.d = u.d + 1
16:                             v.π = u
17:                             Enqueue(Q, v)
18:             u.color = BLACK
```

Do you think we can remove the line 18: u.color = BLACK from the algorithm? Explain why.

Problem 2.

Give a linear time algorithm **via pseudo code** that takes as input a directed acyclic graph $G = (V, E)$ and two vertices u and v, that returns the number of simple paths from u to v in G. Your algorithm needs only to count the simple paths, not list them. **Explain why your code runs in linear time.**

Problem 3.

Suppose we represent a graph $G = (V, E)$ as an adjacency matrix. Give a simple Implementation **via pseudo code** of Prim's algorithm for this case that runs in $O(V^2)$ time. **Explain why your code the running time has the upper bound as $O(V^2)$.**