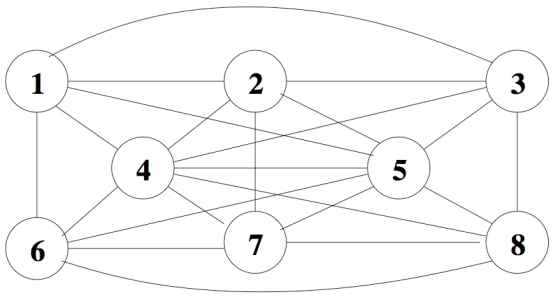
Foundations of Computer Science (Semester 2) – 2015

Assessed Exercise Sheet 9 – 10% of Continuous Assessment Mark

Deadline : 11pm Sunday 22nd March, via Canvas

Question 1 (22 marks)

Represent the following undirected graph as an adjacency matrix:

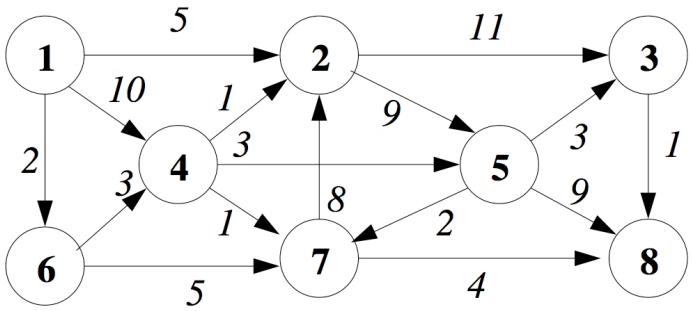


Show how depth-first traversal of the graph can be performed starting from vertex 1. Write down the stack and visited vertices at each stage.

Show how breadth-first traversal of the graph can be performed starting from vertex 1. Write down the queue and visited vertices at each stage.

Question 2 (24 marks)

Represent the following directed graph as a weight matrix:



Represent the same graph as an array of adjacency lists.

Perform a breadth-first traversal of the graph starting at vertex 1. Explain the process you used.

Question 3 (16 marks)

What is the computational complexity of breadth-first and depth-first traversal in terms of the number of vertices *v* and the number of edges *e* when the graph is represented as an adjacency matrix?

How do those computational complexities change if the graph is instead represented as an adjacency linked list?

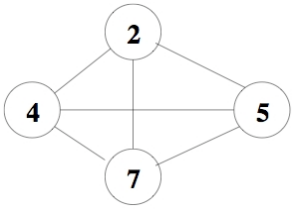
Question 4 (14 marks)

An undirected graph is said to be *connected* if and only if for every pair of non-identical vertices there exists a path from one vertex to the other. Explain in words how you could determine whether a given graph is connected.

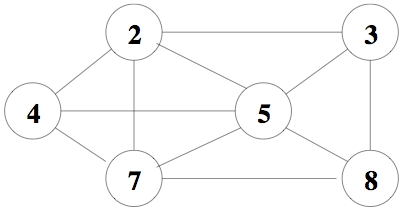
Question 5 (24 marks)

What property must a graph satisfy to be called *planar?* Determine, without using any theorems concerning K_5 and $K_{3,3}$, which of the following graphs are planar, and which are not? In each case, explain in detail how you arrived at your answer.

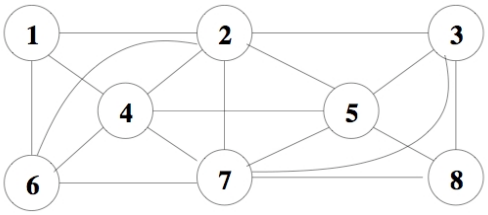
(a)



(b)



(c)



(d)