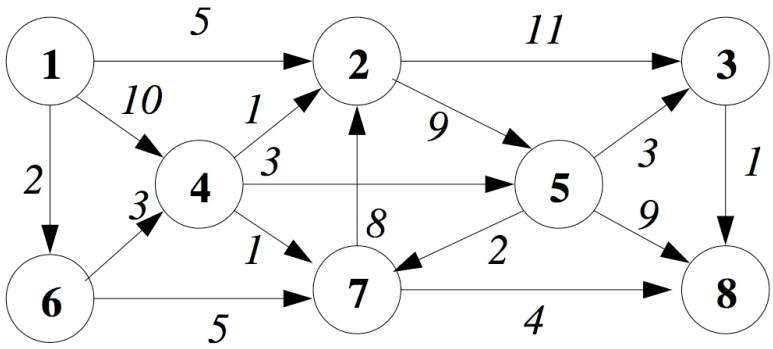
Foundations of Computer Science (Semester 2) – 2015

Assessed Exercise Sheet 10 – 10% of Continuous Assessment Mark

Deadline : 11pm Sunday 29th March, via Canvas

Question 1 (22 marks)

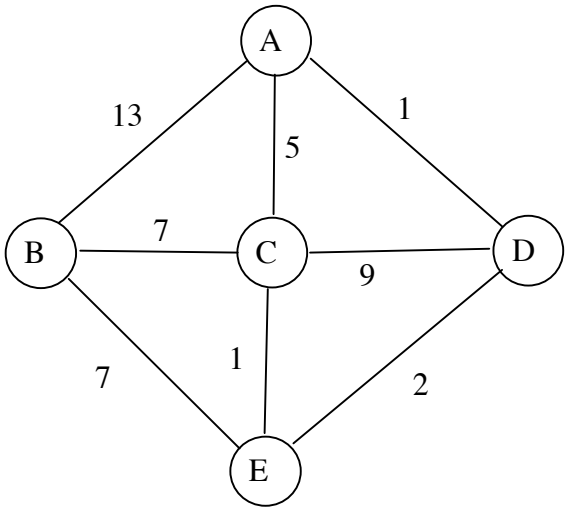
Use Dijkstra's algorithm to determine a shortest path from vertex 1 to vertex 8 in the following directed graph:



At each stage show which nodes are tight, the estimated distances, the previous vertices, and which non-tight node has minimal estimate. At the end, explain how the shortest path is extracted from your computations, and state its length.

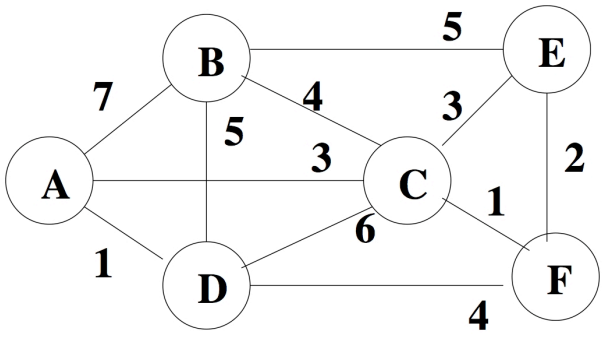
Question 2 (22 marks)

Use Floyds's algorithm to determine the lengths of the shortest paths between all vertices in the following undirected weighted graph. Explain what you have computed at each stage.



Question 3 (14 marks)

Use Kruskal's algorithm to determine a minimal spanning tree for the following graph:



Show the edges that have been added to your tree at each stage.

Question 4 (14 marks)

Use Prim's algorithm to determine a minimal spanning tree for the graph in question 3, starting from vertex A.

Show the state of your tree at each stage.

Question 5 (12 marks)

Explain whether either of Dijkstra's or Prim's algorithms will work correctly on graphs that may have negative weights.

Question 6 (16 marks)

Suppose you have an undirected weighted graph, and starting at a given node you wish to visit each vertex exactly once, returning to the starting point, with minimal overall cost. This is the classic Travelling Salesperson Problem. Outline a simple, though not necessarily efficient, algorithm that would solve that problem. What is it's computational complexity?