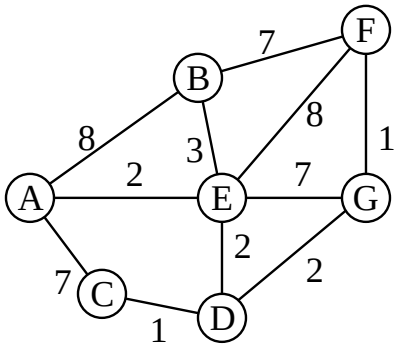
HW #4

ELEN E4710 - Intro to Network Engineering — Due 3/11/2003
Spring 2003 — Prof. Rubenstein

Homework must be turned in at the beginning of class on the due date indicated above. CVN students have one additional day. Late assignments will not be accepted.

1. A connected graph G has n nodes, m edges with weight 1, and all other edges have weight 1000.
   (a) What is the minimum weight that the minimum spanning tree can have?
   (b) What is the maximum weight that the minimum spanning tree can have? (Hint: find the smallest number of nodes that you need to use up all edges of length 1 between).

2. Let v be the smallest weighted edge in a graph G.
   (a) Prove that all MSTs that cover G include the same number of edges of weight v? Hint: consider the (possibly unconnected) subgraph that includes all such edges, and think about the properties of trees.)
   (b) Show that two different SPTs for G can include a different number of edges with weight v.



3. Compute an MST for the above graph using either algorithm covered in class. Write down the order in which edges are added.

4. Compute a shortest path tree rooted at node A.
   (a) using Dijkstra's algorithm.
   (b) using the Bellman-Ford algorithm (include the information about the predecessor node).
   (c) Assume that after the Bellman-Ford algorithm completes (i.e., no further changes are made to the tree), the weight of edge (A, C) changes to 1. Continue the algorithm to find the new shortest path.
   (d) Assume that after the Bellman-Ford algorithm completes for a second time, edge (D, G) changes its weight to 10. Continue the algorithm once more to find the new shortest path.