

### Homework 3

### ICS 163 Graph Algorithms

Due: Wednesday, February 12, 2003, in class

Please answer the following questions, each of which is worth 10 points.

1. Draw a simple, connected, weighted graph with 8 vertices and 16 edges, each with unique edge weights. Identify one vertex as a “start” vertex and illustrate a running of Dijkstra’s algorithm on this graph.
2. Using your graph from the previous exercise, illustrate a running of each of the following Minimum Spanning Tree algorithms (number the edges with the order they are added to the MST).
  - (a) Prim-Jarnik’s algorithm
  - (b) Kruskal’s algorithm
  - (c) Baruvka’s algorithm
3. Give an example of a weighted directed graph  $G$ , with negative-weight edges, but no negative-weight cycle, such that Dijkstra’s algorithm incorrectly computes the shortest-path distances from some start vertex  $v$ .
4. Show that if all the weights in a connected weighted graph  $G$  are distinct, then there is exactly one minimum spanning tree for  $G$ .
5. Describe an algorithm for finding a maximum spanning tree of an undirected connected graph  $G$  with weights on its edges. That is, your algorithm should output a spanning tree that has maximum total weight over all spanning trees. What is the running time of your algorithm?