Due: **Friday, May 29, 2009** at the beginning of class.

**Problem 1. Topological Sort**

Weiss, problem 9.1. Show your work.

**Problem 2. Dijkstra’s Algorithm**

Weiss, problem 9.5(a). Use Dijkstra’s algorithm and show the results of the algorithm in the form used in lecture — a table showing for each vertex its known distance from the starting vertex and its predecessor vertex on the path.

Also show the order in which the vertices are added to the “cloud” of known vertices as the algorithm progresses.

**Problem 3. Negative Weights**

(a) Give an example where Dijkstra’s algorithm gives the wrong answer in the presence of a negative-cost edge but no negative-cost cycles.

   Explain why Dijkstra’s algorithm fails on the particular example you provide.

(b) Suppose you are given a graph that has negative-cost edges but no negative-cost cycles. Consider the following strategy to find shortest paths in this graph: uniformly add a constant $k$ to the cost of every edge, so that all costs become non-negative, then run Dijkstra’s algorithm and return that result with the edge costs reverted back to their original values (i.e. with $k$ subtracted).

   Give an example where this technique fails and explain why it does so. (Hint: one simple example uses only three vertices.) Also, give a general explanation as to why this technique does not work.