FALL 1998: **COMP 7/8713: Advanced Algorithms**

Due Nov 9, in class

Problems

17. (**R**) Exercise 24.2-6, page 510. Does Kruskal's or Prim's algorithm solve this problem, too? Prove or disprove your statement. For extra credit, design a linear-time algorithm for the problem.

18. (**R**) Exercise 24.2-8, page 510. Design your algorithm.

19. (**Ex**) Given a weighted undirected graph G with non-negative edge weights, if the edge weights are all increased by a positive additive constant, can the minimum spanning tree change? Can the output of Dijkstra's algorithm change for some start vertex s? What if it is decreased by a positive constant? What if the edge weights are all multiplied by a positive constant?

20. (**Ex**) Does Dijkstra's algorithm work correctly if some edge weights are negative? Does it work correctly if some edge weights are negative, but there are no negative weight cycles?

21. (**R**) Modify Floyd-Warshall's algorithm to output the number of distinct shortest paths between every pair of vertices in an unweighted undirected graph.

22. (**R**) DOMINATING SET Problem:
    INSTANCE: Graph $G(V, E)$, integer k
    QUESTION: Does G have a dominating set of size at most k.

    A dominating set is a set of vertices that "cover" all the vertices, i.e., every vertex us either in the set or adjacent to a vertex in the set. Prove that the DOMINATING SET problem is NP-Complete.

    Note: I recommend that you try many examples of proofs of NP-completeness. See the problems in your book or the hundreds of problems you will find in *Computers and Intractability: A guide to NP-completeness*, by Garey and Johnson.

23. (**R**)
    INSTANCE: Boolean formula in 3-CNF.
    QUESTION: Is there a truth assignment that makes exactly one literal per clause true?

    Prove that the above problem is NP-Complete.