Summer 2002 **CMSC 251: Homework 8** Clyde Kruskal

Due at the start of class Wednesday, July 9, 2002. (If you want to be sure it is graded by Thursday you should hand it in Tuesday, July 8.)

Problem 1.

(a) Verify that the "is reachable from" relation is an equivalence relation on the vertices of an *undirected* graph. Justify each property (whichever way it is).

What is implied by the fact that "is reachable from" is an equivalence relation?

(b) Which of the three properties of an equivalence relation hold in general for the "is reachable from" relation on the vertices of a *directed* graph? Is it anti-symmetric? Justify each property (whichever way it is).

(c) A DAG is a directed, acyclic graph. Which of the three properties of an equivalence relation hold in general for the "is reachable from" relation on the vertices of a DAG? Is it anti-symmetric? Justify each property (whichever way it is).

Problem 2. Let $G = (V, E)$ be a directed graph.

(a) Assuming that G is represented by an adjacency matrix $A[1..n, 1..n]$, give a $\Theta(n^2)$-time algorithm to compute the adjacency list representation of G. (Represent the addition of an element v to a list l using pseudocode by $l \leftarrow l \cup \{v\}$.)

(b) Assuming that G is represented by an adjacency list $\mathrm{Adj}[1..n]$, give a $\Theta(n^2)$-time algorithm to compute the adjacency matrix of G.

Problem 3. Do Exercise B.5-5 on page 1091 of CLRS. (Exercise 5.5-6 on page 97 of CLR.)

Problem 4. Do Problem B-1 on pages 1091-2 of CLRS. (Problem 5-1 on page 97 of CLR.)