**CSCI 520L**

**Programming Assignment #5**

To be done in the lab

(Friday, Sep. 26, JOUR 102, 2:30-4:10pm)

Show your work in the lab to the GA and also submit your work to the drop box for Assignment 5 (for Week 5) in eCollege

Problem A:

Input: Number n of vertices (i.e. vertex set is {1,2, …,n}), and a list of edges (i,j) for 1 ≤ i,j ≤ n for a directed graph G, and a number k. Read this part from an input file. After this part, read from the console (keyboard) a list of pair of vertices.

Output: For each given pair of vertices i, j, and integer k, output “reachable within k steps” if vertex j is reachable from vertex i in at most k steps via a directed path in G; “not reachable within k steps”, otherwise. Note that a directed path length (i.e. k) can be larger than one.

Goal: Create the directed graph G from the given input, and decide for every given pair of vertices if the second vertex is reachable from the first vertex within k steps via a directed path in G. Assume that every vertex is reachable from itself in zero steps.

Hint: You can maintain an array of vertices in which you mark reachable vertices.

Example input file:

5

1 2

2 5

3 4

1 3

Example dialog (still during the same execution of the program):

Graph G is constructed

1 2 1 <ENTER>

reachable within 1 steps

1 5 3 <ENTER>

Reachable within 3 steps (actually 2)

1 4 1 <ENTER>

not reachable within 1 steps

2 4 4 <ENTER>

not reachable within 4 steps

5 5 0 <ENTER>

reachable within 0 steps

In this assignment, you write a C++ program for Problem A. Both correctness and efficiency of your programs are important. You are required to use ADJACENCY MATRIX to represent arcs of graph G. See a large input file for creating G on Page 3. Test it with your list of pairs of vertices for reachable/not reachable queries.

For a graph with 15 vertices, sample input for the graph-creation:

15

1 7

1 2

1 14

2 4

3 1

3 5

3 9

3 8

4 8

4 10

4 1

5 11

5 13

5 15

6 12

7 2

7 6

7 3

8 2

9 11

9 15

10 14

10 6

11 8

12 9

13 12

13 14

14 7

14 12

14 15