CS 3306 Theory of Computations

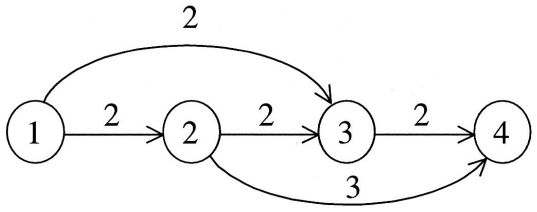
Project 2 Floyd's Shortest Path Algorithm

A shortest path between vertex *a* and *b* is a path with the minimum sum of weights of the edges on the path. Floyd's algorithm finds the shortest paths of all vertex pairs of a graph. (read Section 4.1).

Write a program using C++ to find shortest paths of a graph. The graph is represented by an adjacency matrix. The adjacency matrix of a graph G = <V, E> is matrix M defined as:

$$M_{ij} = \begin{cases} 0 & if \quad i = j \\ w_{ij} & if \quad i \neq j \wedge v_i \xrightarrow{w_{ij}} v_j \in E \\ \infty & otherwise \end{cases}$$

For example, the adjacency matrix of the following graph is on its right side:



$$M = \begin{bmatrix} 0 & 2 & 2 & \infty \\ \infty & 0 & 2 & 3 \\ \infty & \infty & 0 & 2 \\ \infty & \infty & \infty & 0 \end{bmatrix}$$

The following is Floyd's algorithm:

```
for k := 1 to n for i := 1 to n for j := 1 to n do
        if Mik + Mkj < Mij then
                Mij := Mik + Mkj;
                Pij := k
        fi
```

The input of your program should be in the following format:

<the number of vertices of the graph>
<the adjacency matrix, arranged line by line>

For example, the input corresponding to the above graph is:

```
4
0 2 2 -1
-1 0 2 3
-1 -1 0 2
-1 -1 -1 0
```

Note that infinity is represented by -1.

The output of your program should include an echo-printing of the input matrix, the resultant adjacency matrix M and the shortest path information matrix P, each labeled properly. For example, the output for the above input is:

Input matrix M:
4
0 2 2 -1
-1 0 2 3
-1 -1 0 2
-1 -1 -1 0

Resultant matrix M:
0 2 2 4
-1 0 2 3
-1 -1 0 2
-1 -1 -1 0

Path matrix P:
0 0 0 3
0 0 0 0
0 0 0 0
0 0 0 0

Your are required to test your program using Windows Visual Studio. Your program must prompt for the input file name and path, read input from a text file, and print out the output to the screen.

Test your program using several cases you have created. Submit your program in Blackboard Vista prior to the class time on the project due day. Late submission is subject to late penalty. Submission will not be acceptable two weeks after the due day.