CSCE 2110
Fall 2015
Program 4 – Shortest Path Between Cities
100 Points
Date Due: Wednesday, November 25, 2015 (Start of Class)

Program 4 represents the final piece of the implementation of a Road Atlas and Driving Distance Calculator. Specifically, Program 4 adds a single command (distance A B) to calculate the SHORTEST PATH between cities "A" and "B". We studied Dijkstra's Algorithm for determining the shortest path, but you may use any method that you would like.

User input will be in the form of commands. The user must be able to input commands via the command line OR from a file in a CSV format. **BOTH input methods must be available to the user.** This format will allow the easy creation of a large number of inputs quickly without the need for a long series of prompts and responses. The commands used in the CSV file are identical to the command line commands EXCEPT, of course, each field of the command in a CSV file is separated by a comma. Also, neither the command "file" nor the command "Quit" will be issued from a CSV file. These are NOT "error conditions" that must be handled ... it is just a promise from the instructor. Once all commands in a given command file have been processed, the program returns to the interactive mode with a command prompt.

Program 4 must build an Undirected or Directed Graph from user input in accordance with the instructions provided for Program 3. While there is no intent to "retest" Program 3 capabilities, it is assumed that all Program 3 functionality is in place in order to build the necessary graph of cities and roads. The only planned test for this program is the execution of the "distance" command. If you know there are deficiencies in you Program 3 submission that will preclude the creation of a full graph, those deficiencies must be corrected before submission.

There will only be **ONE SUBMISSION PER TEAM** for Program 4. Therefore, your team should evaluate the Program 3 submissions of all Team members and decide which program will serve as the basis for this exercise.

As always, I strongly suggest that you get the programs done and submitted as quickly as possible. Once your Program has been submitted, Dr. Burke will personally evaluate your program.

ALL requirements of Program 3 must be satisfied with Program 4 in addition to the following:

1. **Print the shortest distance and route from city A to city B on the graph.** The user provides a pair of city names (nodes) and the program provided the SHORTEST PATH between those cities. If the either does not exist in the graph, just print an error.
    - FORMAT: **distance city1 city2** ==>
        - EXAMPLE: **distance NA NB**
            - Return: NA
                NC S01 11
                NE S05 13
                NG S09 22
                NB (TOTAL: 46)

            - Error: If a city does not exist, print the following error message:
                ***** ERROR *** NODE DOES NOT EXIST: NB**

PROGRAM SUBMISSION:
Submit INDIVIDUAL program files with CSCE-2100 Specified Filenames (**NO *.zip files, NO *.tar files, NO *.rar files**) to BlackBoard before the due date. The file naming convention must conform to the standard as described in the instructions for Program 1.

Multiple submissions of one or all of your files will be allowed. Your program files will all be extracted to a single UNIX (csexx.cse.unt.edu) subfolder and will be compiled with the command: **make**
Once compiled, we will execute with command: **make run**