

CS380 Algorithm Design & Analysis

Assignment 5: Path Finding

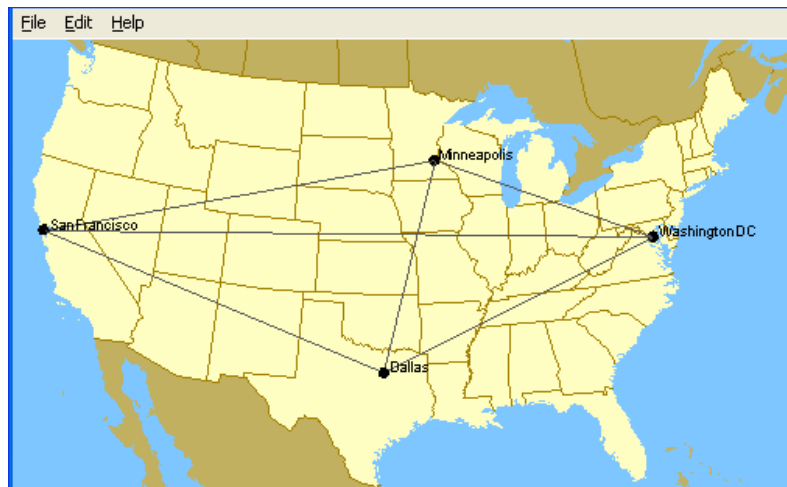
Date Assigned: Tuesday, April 14, 2009

Date Due: Tuesday, April 28, 2009

Total Points: 45pts

For this assignment you are to implement some basic graph algorithms to answer questions related to map data.

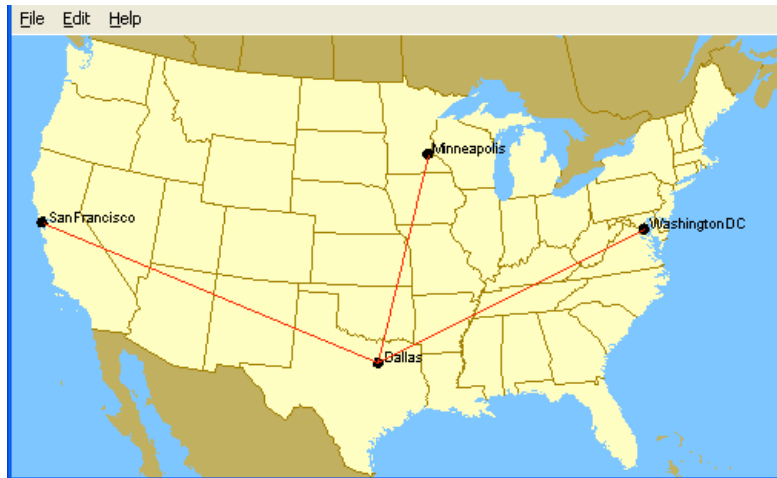
For example, given the map below, a question might be: what is the shortest path from San Francisco to Washington DC?



The answer to which is 2200 miles using the path below.



Another question one might ask is: What is the minimum spanning tree for this graph? For which the answer would be the graph below. The total network length is 3794 miles.



Input:

The input to your program is a text file that contains the following:

Line: Background image filename.

Line: The word (NODES) indicating the beginning of a list of nodes (vertices).

Line: Node-Name x-coordinate y-coordinate

Lines: Other node details

Line: The word (ARCS) indicating the beginning of a list of arcs (edges).

Line: Node-Name Node-Name Distance

Lines: Other arc details

Example:

```
USA.bmp
NODES
WashingtonDC 5.71 2.25
Minneapolis 3.76 2.93
SanFrancisco 0.278 2.31
Dallas 3.31 1.04
ARCS
Minneapolis SanFrancisco 1777
Minneapolis Dallas 935
Minneapolis WashingtonDC 1600
SanFrancisco WashingtonDC 2200
Dallas SanFrancisco 1540
Dallas WashingtonDC 1319
```

Output:

Your program should read in the file, load up the image file and superimpose the graph over the top of that as shown in the examples above. You are then going to display the following menu to the user:

Please enter name of graph data file: Small.txt

Your options are:

- (1) Choose a new graph data file
- (2) Find shortest path using Dijkstra's algorithm
- (3) Compute the minimal spanning tree using Kruskal's algorithm
- (4) Quit

Enter choice:

Selecting option 2 will output the following:

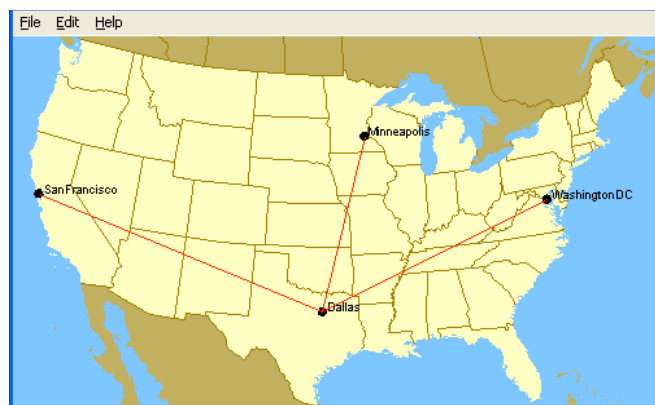
Click on starting location... SanFrancisco chosen.
Click on ending location... Dallas chosen.

Finding shortest path using Dijkstra...
Done! The shortest path from SanFrancisco to Dallas is 1540 miles.
The algorithm dequeued 1 paths to find the optimal one.



Selecting option 3 will output the following:

Minimal spanning tree now displayed.
Total network length is 3794 miles.



What I am Providing:

In order to display the .bmp maps, draw vertices and edges, and handle mouse clicks, I am providing you with a library and some basic code that is available under the Creative Commons License from Stanford University:

(<http://see.stanford.edu/see/materials/icspacs106b/assignments.aspx>)

In order to use the code you will need to do the following:

- You must use Visual Studio 2005. Install it and run it at least once before proceeding to the next step.
- You must run the program setup.exe located in the folder (PCLibs-VS2005-ADT-Installer) on Turing. Be sure to copy the folder to your desktop before running it.
- Create a new project of type (CS106B/X C++ Assignment Wizard). Make sure you do this instead of creating an Empty Project like we usually do.
- Import the code found in pathfinder.cpp into your project.
- Build and run your code. It should run and display two windows: one for the image and one for the text.

The file (pathfinder.cpp) has some functions that have already been created for you. You will need to call these functions to draw the vertices and edges to the graph window. The file (pathfinder.cpp) uses functions from the libraries graphics.h and extgraph.h. You can go to this website for documentation on both of these libraries:

<http://www.stanford.edu/class/cs106x/documentation/files.html>

I will also be providing you with two test input files that will work with the image USA.bmp, which I am also providing.

Object-Oriented Design

- You must use object-oriented design for this project. Do not place everything into one file!
- Think about creating a graph class that can be used for other graph applications. You never know, but your next assignment may well be another graph assignment 😊
- You will need to use a priority queue for this assignment. Reuse your priority queue from assignment two!

What to Submit

- Submit an electronic copy of your project by 9:40am on the day that it is due. Name your project “05PUNETMap”, replacing PUNET with your PU Net ID (i.e. khoj0332).
- A summary of the time that you spent working on this assignment (give me a number!!!!), and what slowed you down the most. Submit this document electronically as a Google Document called “02PUNetPart1” for example “02khoj0332Part1”. Create the Google document and share it with me at ShereenKhoja@gmail.com.