Assignment 3 – deadline: lab 4 (week 7-8)

Solve 1 of the following problems (assigned to you in the Attendance Table) using the graph that you implemented in Assignments 1 and 2:

A) Model the road map, in order to find the best route from one place to another. Consider one-way streets (including restriction to turning into one way streets in intersections) and turn costs (having to give way to more traffic takes more time).

From a file containing the roads create the corresponding graph. The file containing roads has on each line the name of the road, if it is two way then a list of intersection it passes through (in the order it passes through) with the cost saying how much time it takes to get to that intersection from the last one: E.g. Bell Road, two way, (i1, 0), (i3, 5), (i4, 6), …

1. Considering that you have another file with all the intersections and their physical location on a 2D grid, create an A* algorithm that finds the fastest path to go from one intersection to another

2. Find the time it takes to go from each intersection to each other intersection, using the Floyd-Warshall Algorithm.

3. Find the time it takes to get from one intersection to all other intersections using the Uniform Cost Search algorithm.

B) Model the metro network, in order to find the best route from one metro station to another. Changing the metro (unboarding a metro going on one line and boarding another metro, on another line, in the same station) is to be penalized, say, as much as traveling 3 stations (because you need to wait for the next metro). The simple approach, where each station is a vertex and you put an edge between two stations iff they are consecutive on a line, cannot take into account the cost of changing lines.

From a file containing the metro lines create the corresponding graph. The file containing metro lines has on each line the name of the line, then a list of stations it passes through (in the order it passes through) with the cost saying how much time it takes to get to that station from the last one: E.g. M1 (s1, 0), (s3, 5), (s4, 6), …

1. Find the time it takes to get from one station to all other stations using Dijkstra's algorithm.

2. Considering that you have another file with all the stations and their physical location on a 2D grid, find a route from one station to another using the Greedy Algorithm.

3. Find the time it takes to get from one station to all other stations using Bellman-Ford's algorithm.

C) Consider the wolf-goat-cabbage problem. (A man has wolf, a goat and a cabbage and wants to cross a river with them using a boat that has room only for one of the three things. So, at each move, the man crosses the river with either an empty boat or with one of the three things. The rule is that he cannot let the goat with the cabbage or the wolf with the goat, unattended. The goal is to get with all three things on the other side in as few moves as possible.) Model this problem as a graph.

Create a function that generates the graph corresponding to the problem.

1. Solve the problem using the generated graph and the BFS algorithm. Print the solution.
2. problem using the generated graph and the DFS algorithm. Print the solution.