Intro to IS

Lab 1: Year Round Orienteering

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1. **Introduction:**

   The goal of this lab is to traverse through the map of Mendon Ponds Park and figure out the best way to travel through all the required points within shortest time possible. The map consists of various terrains which are represented using different colors. Speed of moving through each terrain is different and it plays an important part in determining the best path.

   A* algorithm is used to achieve this goal. Heuristic is calculated for all possible paths and the best path is selected among all. The entire process will be discussed as we move along the write up. Weather also is an important factor in here as some paths might be faster for a particular season and can turn out of no use for some other season.

2. *class Node*()

   Every point to be traversed is represented a node and connected to other node so that the sequence of traversal of nodes can be easily determined and their properties can be looked upon quickly.

3. *A_star_path*()

   This is the main method call which then calls for other methods to perform small operations. In this method, the traversal route is appended to a list and for each point cost is calculated to reach the end point. From each point, next step can be any one path towards 8 direction. One important condition to check here is that every the next possible pixel should be within the boundary of the map size.

4. $calculate_cost()$

   The cost function calculates the time required to travel from source pixel to destination pixel. Distance traveling on horizontal line is 7.55, where as for vertical line it is 10.29. Using these values we determine the diagonal distance as 12.76.

   The time required also depends on other factors. First the terrain in which the contestant is moving. Depending on the terrain, the contestant can move faster or slower or can not pass through it at all. Second characteristic is the elevation. If the elevation increases, speed will decrease and thus increase the travel time. It is also true other way around.

5. *getSpeed*()

   This method returns the speed a candidate can move over a terrain. Following speeds are taken into consideration.

Terrain	**Speed (mph)**
Open Land	3.0
Rough meadow	2.0
Easy movement forest	2.5
Slow run forest	2.0
Walk forest	1.0
Impassible vegetation	0
Lake/Swamp/Marsh	0
Paved road	4.0
Footpath	3.0
Out of bounds	0
Snow	0.5
Muddy path (Spring)	0

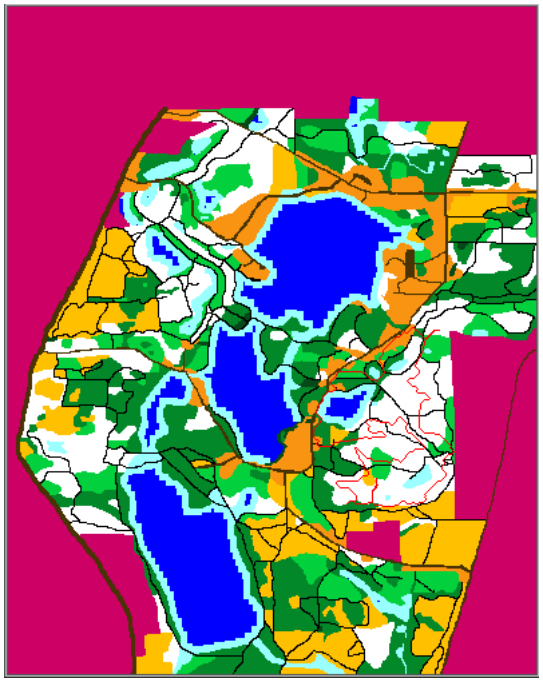
6. *calaulate_Heuristic*()

   I am calculating heuristic in the easiest way possible i.e. taking the Euclidean distance between the point and goal point.

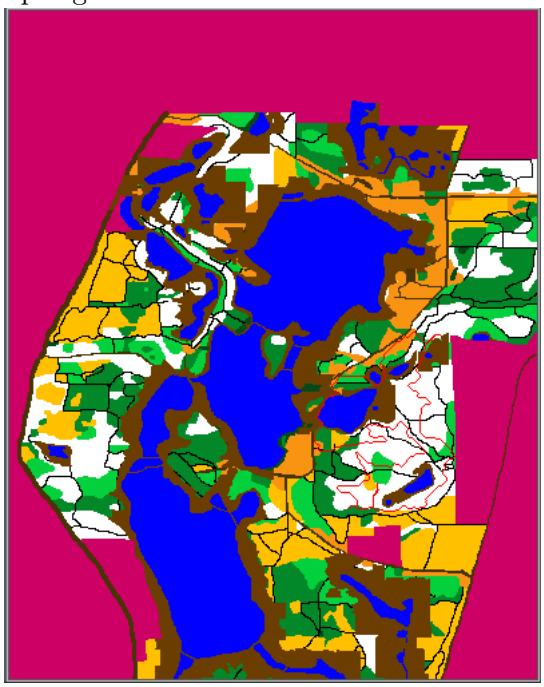
7. *ClimateChange*

   As mentioned above climate change play an important role here as it changes the map and thus changing the speed of contestant. For winter and spring BFS operation is performed on the map around water body and then A* algorithm is performed over this new map.

(a) Winter



(b) Spring



8. *Execution*

   The program accepts 5 parameters and the command is as shown below.
   python3 lab1.py terrainImage elevationFile pathFile seson outputFileName

   e.g. python3 lab1.py terrain.png mpp.txt red.txt summer terrainOutput.png
   Output