CSCI 630 Foundation of Artificial Intelligence

Lab 1 : Year-round Orienteering

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Function Descriptions and Assumptions:

1. Heuristic function :
   For heuristic function all the values are in unit of time.To find heuristic of a Coordinate pair(node) from a target node. We first calculate the euclidean distance from a the node to target node and then divide the distance by maximum value of speed from speed dictionary making it the most ideal value and calculating and making it the minimum value that could have been possible by direct path to target node.

2. Travel-cost function :
   For Travel function all values are in terms of time.To calculate the travel cost from one node to another we take the difference of height of elevation from a node with its neighbours and then divide the gradient difference by the speed of the neighbouring terrain to get the existing time taken to be considered for movement.

   For positive gradient to decrease the value of speed the cost of gradient is increased by 10% to make it climb slower.

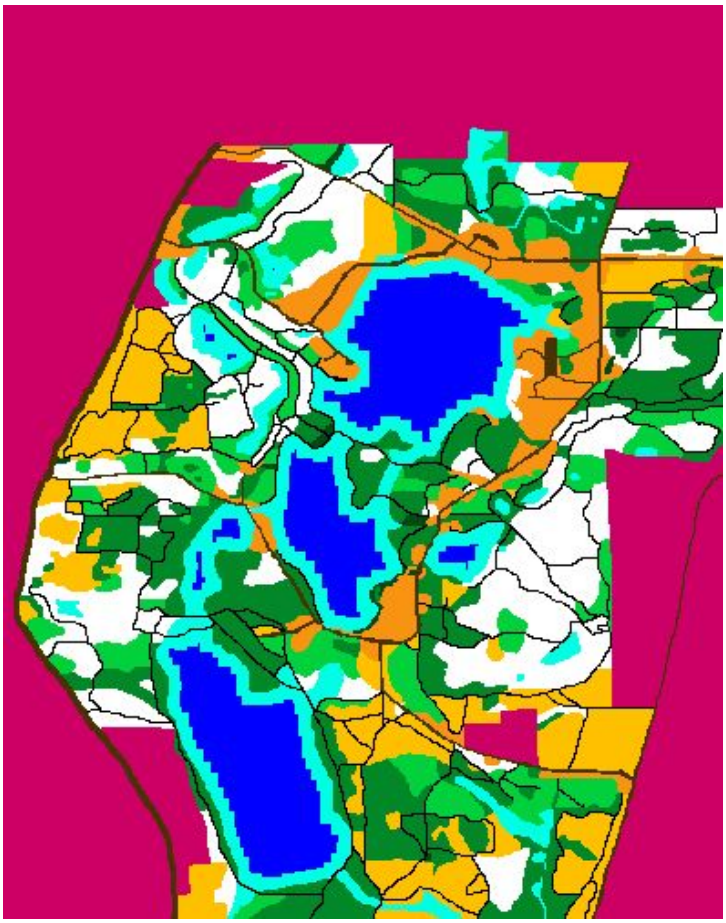
   For negative gradient to increase the value of speed the cost of gradient is decreased by 10% to make it faster to climb down.

3. A* search graph :
   For making A* Search graph we start from the start index of the file given and continue the graph till the target node is popped from the priority queue.
   - Create a priority queue and start adding the neighbours of the start node.
   - Add all neighbours of the node to priority queue with total cost of heuristic value and travel cost.

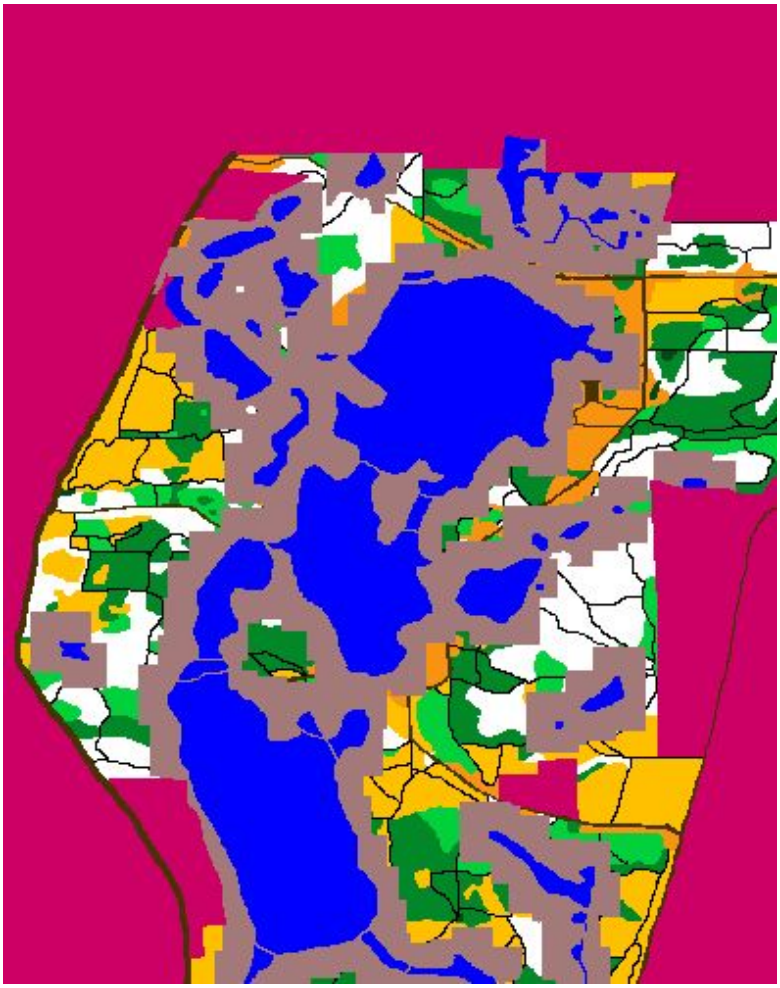
- Pop the value with minimum cost.
- Append the popped value to graph dictionary with the value of parent node for backtracking.
- Add all neighbours of popped node to priority queue.Continue this till the target node is popped out from the priority queue with minimum possible value.

4. Fall Season :
   For season of fall All the paths passing through easy movement forest is been have been set to reduce speed to 30% of the speed than the normal speed of the terrain.
   Assumed Easy Forest speed : 0.7120 meters/second

5. Freeze water function :
   For season of Winter we need to freeze the water bodies that are from 7 pixels from the banks of water bodies and shore inside the water and can be walked on with a separate terrain speed.
   - First find the list of nodes for edges of the water bodies
   - Look for neighbours layer by layer by BFS from initial set of nodes of every such node if they are water transform them to ice terrain else let them just be.
   - Continue this this cycle for 6 more times to reach the depth of 7 pixels.
   - Assumed Speed : 1.1458 meters/second



6. Make mud function :
   For season of Spring we need to make mud on land that are from 15 pixels from the the banks of water bodies and shore outwards the water upto the maximum height of 1 meter from the water body and can be walked on with a terrain speed of water assuming them to be underground.
   - First, find the list of nodes for edges of the water bodies
   - Look for neighbours layer by layer by BFS from initial set of nodes of every such node if they are water transform them to ice terrain else let them just be.
   - Continue this this cycle for 6 more times to reach the depth of 7 pixels.
   - Assumed Speed : 0.5210 meters/second



7. Elevation_file;
   Had to take the transpose of the elevation file provided to correspond it to the image file.

8. Speed Dictionary:

Terrain type	Color on map	Colour	Assumed Speed (mtr/s)
Open land	#F89412 (248,148,18)	A	2.352
Rough meadow	#FFC000 (255,192,0)	B	1.78816
Easy movement forest	#FFFFFF (255,255,255)	C	2.0120 Fall : 0.7120
Slow run forest	#02D03C (2,208,60)	E	1.6412
Walk forest	#028828 (2,136,40)	F	1.7956
Impassible vegetation	#054918 (5,73,24)	G	1.0234
Lake/Swamp/Marsh	#0000FF (0,0,255)	H	0.5210
Paved road	#473303 (71,51,3)	K	2.68224
Footpath	#000000 (0,0,0)	M	2.592283
Out of bounds	#CD0065 (205,0,101)	O	0
Ice	#00FFE5 (0,255,229)	P	1.1458
Mud-Swamp	#A37979 (163,121,121)	Q	0.5210