20CS4033 AI – I

Fall 2022

Instructor: Anca Ralescu

**Homework Assignment #2**

**Assigned on September 8, 2022**

**Due on September 19, 2022**

**11:59PM on Canvas**

**50 points**

In this assignment you are asked to implement uninformed and informed search for the Romanian road map data given in your textbook (and the figure below).

Diagram

Description automatically generated



Table

Description automatically generated

For all searches, use Bucharest as the goal city.

You will implement:

1. Breadth first (10 points)
2. Depth first (10 points)
3. Best first (greedy algorithm) (10 points)
4. A\* algorithm (10 points)

Compare their performances from two points of view as follows:

1. Correctness (i.e., finds the path from a start city to the goal city), or returns empty if no path exists (5 points).
2. Efficiency (consider the number of cities visited before the path is found or the algorithm returns that there is no path (in this latter case, you may want to put a bound on how many times the same cities are revisited) (5 points).

Note that in each type of search the same high-level strategy is used as shown in the pseudocode from the textbook: maintain the nodes to be expanded in the fringe – always implemented as a queue. The difference is on the criterion on how the queue is constructed:

1. In *depth first*, the children of the current node are put in the *front* of the queue.
2. In *breadth first*, the children of the current node are put in the at the *back* of the queue.
3. In *best first*, the queue is maintained in *nondecreasing order of the SLD, h(n), of the* children of the current city to the goal city. That is, the children of the current node with smallest h(n) are put in the front of the queue. Output the path generated and its cost.
4. In A\* the queue is maintained in *nondecreasing order of the SLD, f(n)=g(n)+h(n), of the* children of the current city to the goal city. In this search the algorithm may need to backtrack to a previous node when the value of f(n) is smaller than at the current node. Output the path generated and its cost.

The *best first* is obtained by modifying depth-first algorithm.

The A\* algorithm is obtained by modifying the breadth first algorithm.

Each time a node is retrieved from the front of the queue, the algorithm tests if it is the goal node, and when the test returns true, the algorithm ends.

To begin with, a path is empty. Eventually, the path must start with the START node, and each node is added to it according to a search specific criterion. The path is a list of cities.

When there is no path, each algorithm should return an empty path.