Middle East Technical University | Department of Computer Engineering

CENG 580

Multi Agent Systems

Spring 2021-2022

Homework 2

Due date: 17 May 2022, Tuesday, 23:59

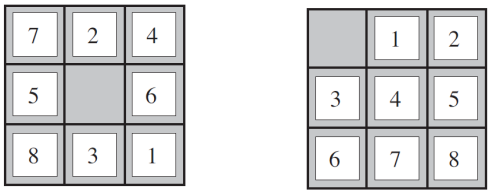
1 Problem Definition

In this assignment, you are going to solve a given 8-puzzle by using Multi Agent Real-Time A* (MARTA*) with **repulsion**. You will use the admissible heuristic *"sum of Manhattan distances of misplaced tiles."*

You probably know what 8-puzzle is, but just to refresh your memory, here is the definition of 8-puzzle:

8-puzzle is a game consisting of a 3 x 3 board with 8 sliding tiles and a blank space where the aim is to reach a specific configuration from a given configuration by moving the tiles near the blank space.

Here is an example of initial and goal configurations for 8-puzzle:



(a) initial state (b) goal state

Figure 1: Example configurations as initial and goal states for 8-puzzle (taken from [1])

2 I/O Format

Input Format: input file name is `input.txt`

- the first line contains an integer specifying the number of agents, $n \geq 1$
- the initial state is given as a 3 x 3 matrix (non-blank tiles are numbered with 1, 2, ..., 8 and blank one is 0)
- the final state is also given as a 3 x 3 matrix

Sample Input:

```
3
8 1 3
7 2 4
6 5 0
1 2 3
8 0 4
7 6 5
```

Output Format: output file name is `output.txt`

Write step by step the state (as a vector, row-wise) and the move (one of R , L, U, D) taken by each agent.

Sample Output:

```
Step:1
Agent1: D [8 1 3 7 2 0 6 5 4]
Agent2: R [8 1 3 7 2 4 6 0 5]
Agent3: R [8 1 3 7 2 4 6 0 5]

Step:2
Agent1: R [8 1 3 7 0 2 6 5 4]
Agent2: D [8 1 3 7 0 4 6 2 5]
Agent3: R [8 1 3 7 2 4 0 6 5]

.
.
.

Step: 26
Agent1: R [1 2 3 8 0 4 7 6 5]
Agent2: L [1 2 3 8 4 7 0 6 2]
Agent3: U [1 2 3 7 6 0 8 4 5]

Agent1 reaches the goal.
```

3 Regulations

1. **Implementation:** Platform/Language: Unix / C
2. **Submission:** Submit your sources codes in a zipped file named in the format of `HW2-Name-Surname.zip` through the assignment activity on `OdtuClass`.

   Please do not forget to compile and run your codes on INEK machines before submission. You may use ssh to use one of these machines remotely as below:

   "ssh -p 8085 e1234567@external.ceng.metu.edu.tr" command will allow you to connect the network of our department through "divan" machine, where e1234567 should be replaced with your username. After you log into divan you can type "ssh inek#" to log in inek machine with the number #.

Availabilty of inek machines can be checked via the following link:

`http://ceng.metu.edu.tr/ineks.html`

References

[1] S. J. Russell and P. Norvig, *Artificial intelligence: a modern approach.* Malaysia; Pearson Education Limited, 2016.