

CENG 580

Multi Agent Systems

Spring 2025

Homework 1

Due date: April 2, Wed, 23:59

1 Problem Definition

In this assignment, you are going to solve a given 8-puzzle by using Multi Agent Real-Time A* with **attraction** (MARTA*). 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:

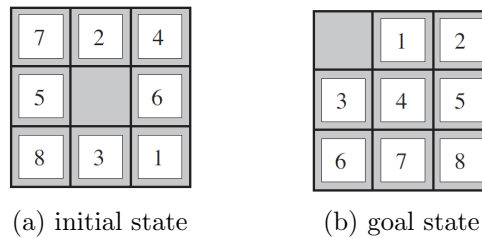


Figure 1: Example configurations as initial and goal states for 8-puzzle (taken from [?])

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:** Language: Python
2. **Submission:** Submit your sources codes in a zipped file named in the format of `HW1-Name-Surname.zip` through the assignment activity on `OdtuClass`.