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LP 1 - AIR I

* Title: 8-puzzle problem using A*.

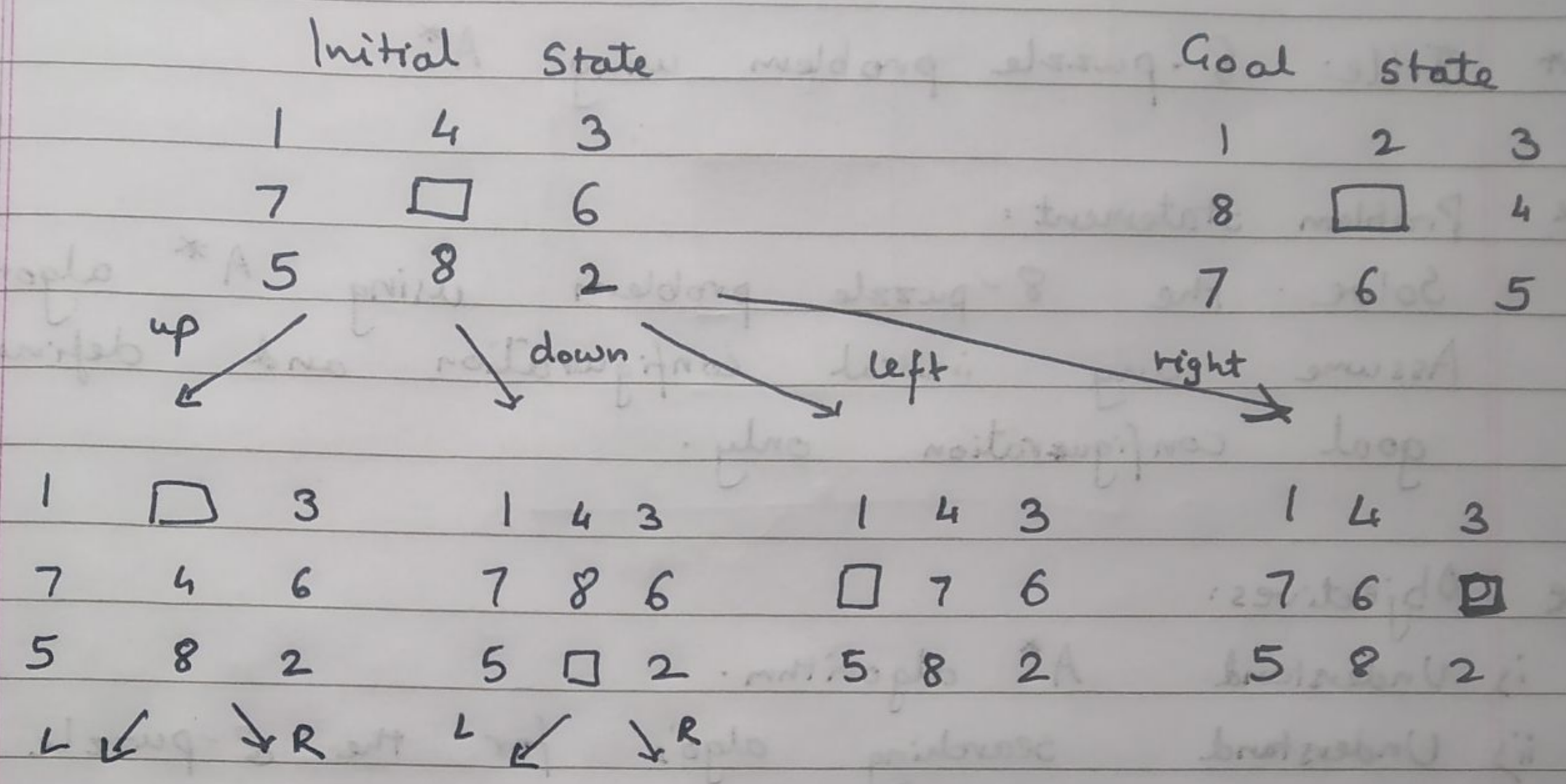
* Problem Statement:
Solve the 8-puzzle problem using A* algorithm. Assume any initial configuration and define goal configuration only.

* Objectives:
i) Understand A* algorithm.
ii) Understand searching algo's for the 8-puzzle problem.

* S/w and H/w requirement.
64 bit processor
RAM
Linux OS

* Theory:
8-puzzle problem:
→ The puzzle is divided into $\sqrt{N+1}$ rows and $\sqrt{N+1}$ col's. So, 8 puzzle problem will have 3 rows and 3 columns.
→ The puzzle consists of 8 tiles and 1 empty space where the tile can be moved.
→ Start and goal configurations (also called states) of the puzzle can be solved by moving the tiles one by one in a single empty space and thus achieving the goal configuration.

* State space of the 8 puzzle problem:



In this way, children states of the current state can be derived, because the empty space can only be moved in 4 directions, which is further restricted by the position.

* A* algorithm:

i) The A* algo. integrates characteristics of uniform cost search and heuristic based search to find the optionally efficient solution.

ii) The key feature of A* is that it keeps track of each visited node which helps in ignoring the already visited nodes, as well as a list of nodes yet to be explored. From this list, it chooses the most optimal node.

iii) So, we use 2 lists namely -
a) Open List and b) Closed list.

iv) Open list contains all the nodes that are being generated and are not existing in the closed list.

v) As each node is explored, it is added to the closed list and its neighbours are added to the open list, this is how the nodes expand.

The metric used to determine optimality of a node is the F-score.

F-score = h-score + g-score
- h-score ↙ : how far the goal node is
- g-score ↘ : number of nodes traversed from start to current node.

The h-score is the Manhattan dist. (dist betⁿ 2 points)

$$h\text{-score} = |x_1 - x_2| + |y_1 - y_2|$$

* Conclusion:
From this assignment, I was able to understand the basics of 8 puzzle problem and the A* algorithm and hence implement this assignment.