Assignment 1

Using Informed and Uninformed Search Algorithms to Solve 8-Puzzle

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Problem statement:

Solving 8_puzzle game using algorithms like BFS , DFS and A*

the data structure used (if any) and algorithms:

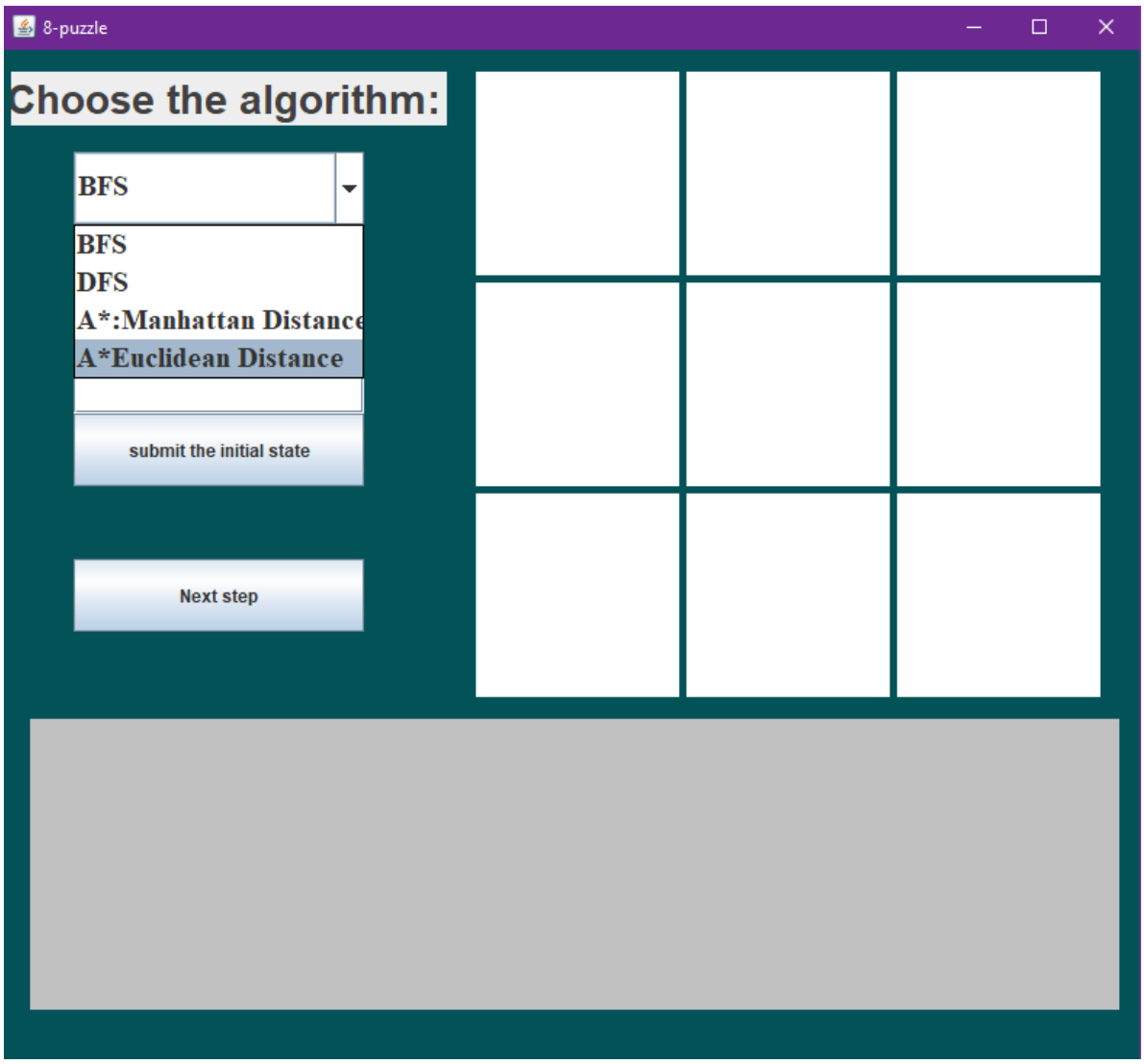
1. Queue: in BFS technique as frontier.
2. Stack: in DFS technique as frontier.
3. Priority Queue: in A* as frontier.
4. Hash set: as explored list, as frontier set in BFS and DFS, as the running time of queue and stack is O(n).
5. Hash map: in A star Manhattan and A star Euclidean to store the lowest cost for the states that are currently in the frontier only, as the complexity of the priority queue is O(n).
6. Linked list: to store children(neighbours) and the path.

Assumptions:

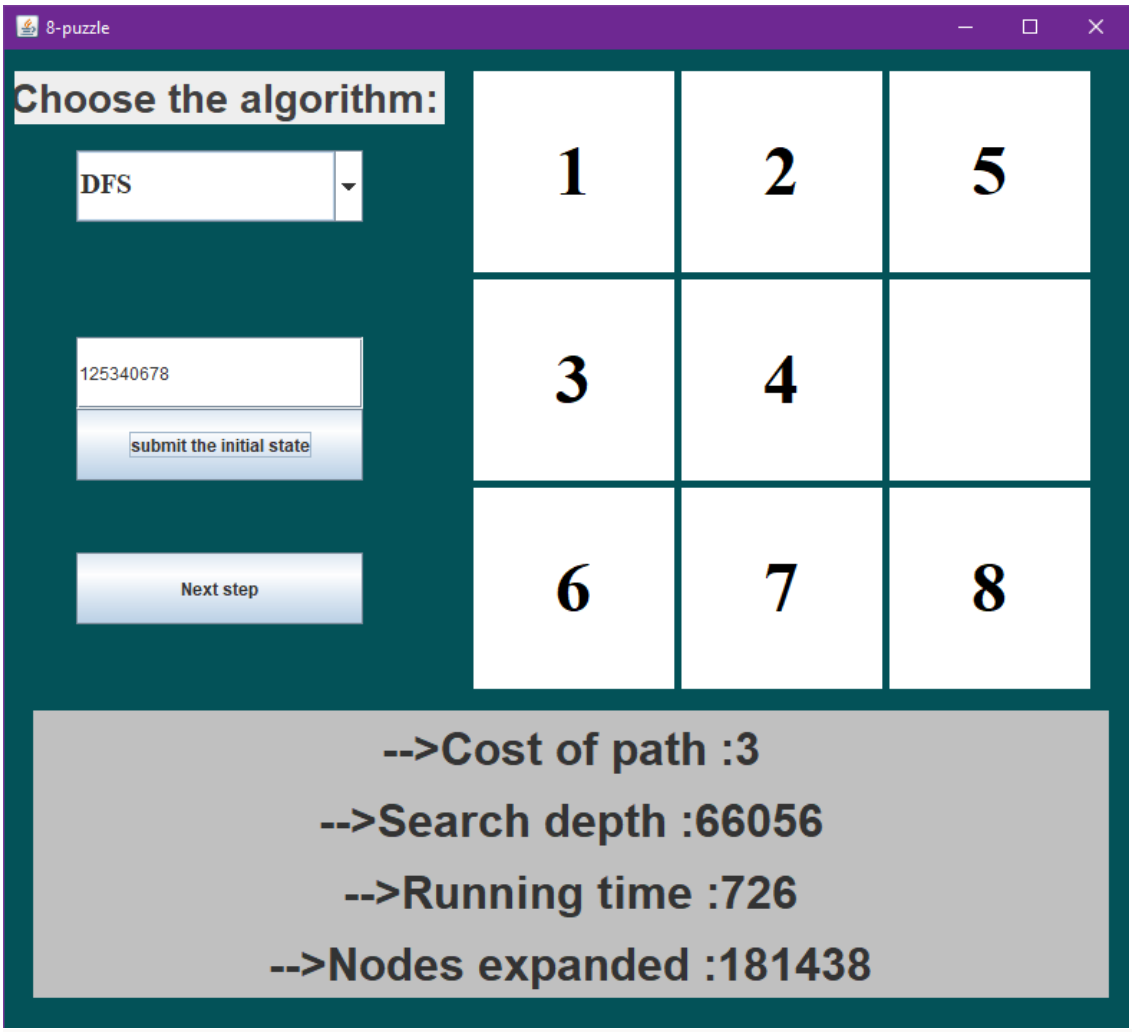
- The code can detect any unsolvable and invalid states and does not solve them.
- Simulation to show the path to the goal (by pressing button next step)
- We assumed that the algorithm moves up the down then right then left

How to use:

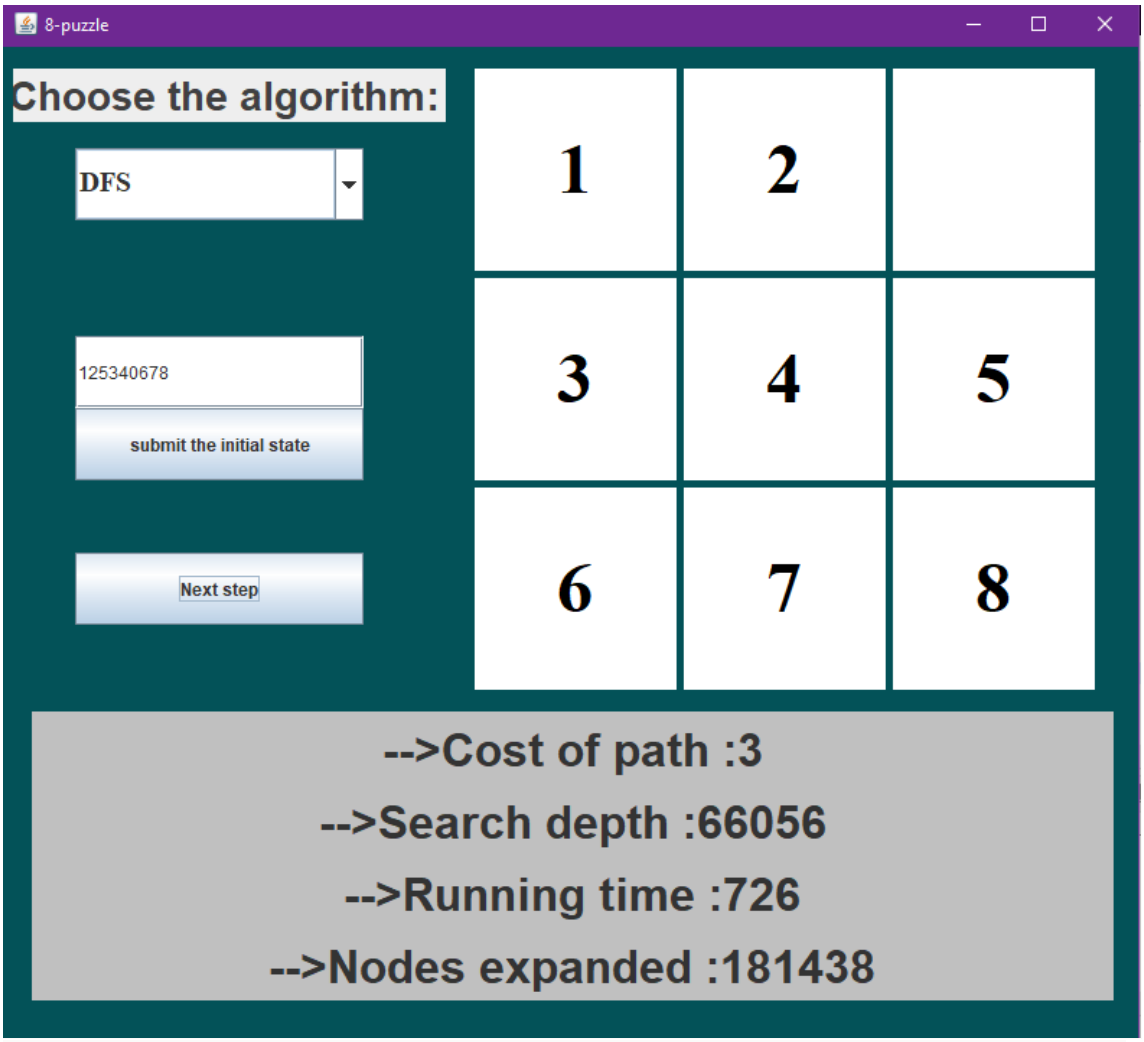
- To run the program user should first choose the search algorithm that he wants from the drop-down menu (BFS, DFS, A* Manhattan, A* Euclidean) used to solve the puzzle.



- Then enter the initial state in this form (012345678) and press on submit button, numbers will appear on the square, the results (the path to goal, cost of path, nodes expanded, search depth and the running time) also will appear under it.



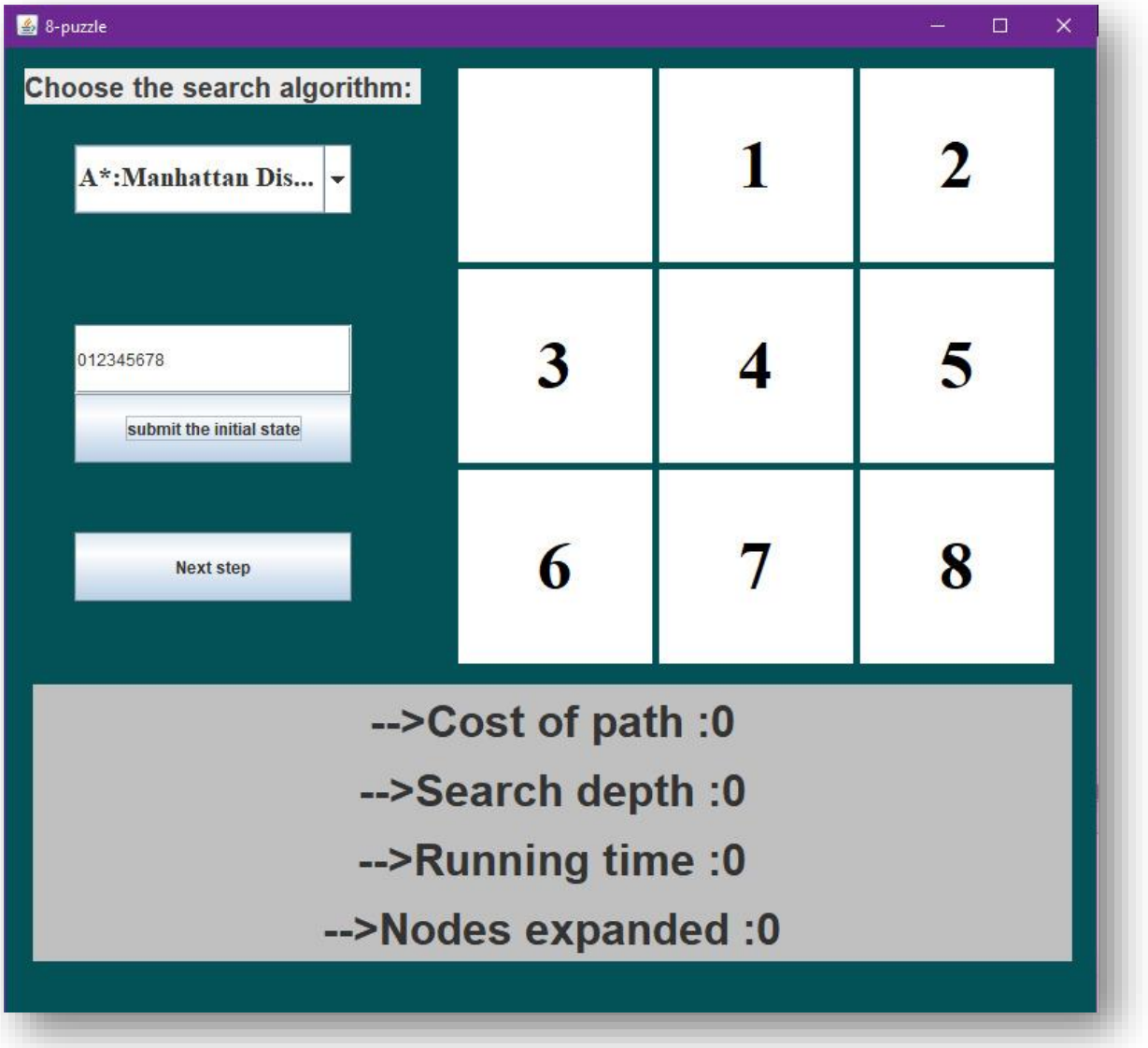
- Pressing the next step button to show all the steps of solving the puzzle.



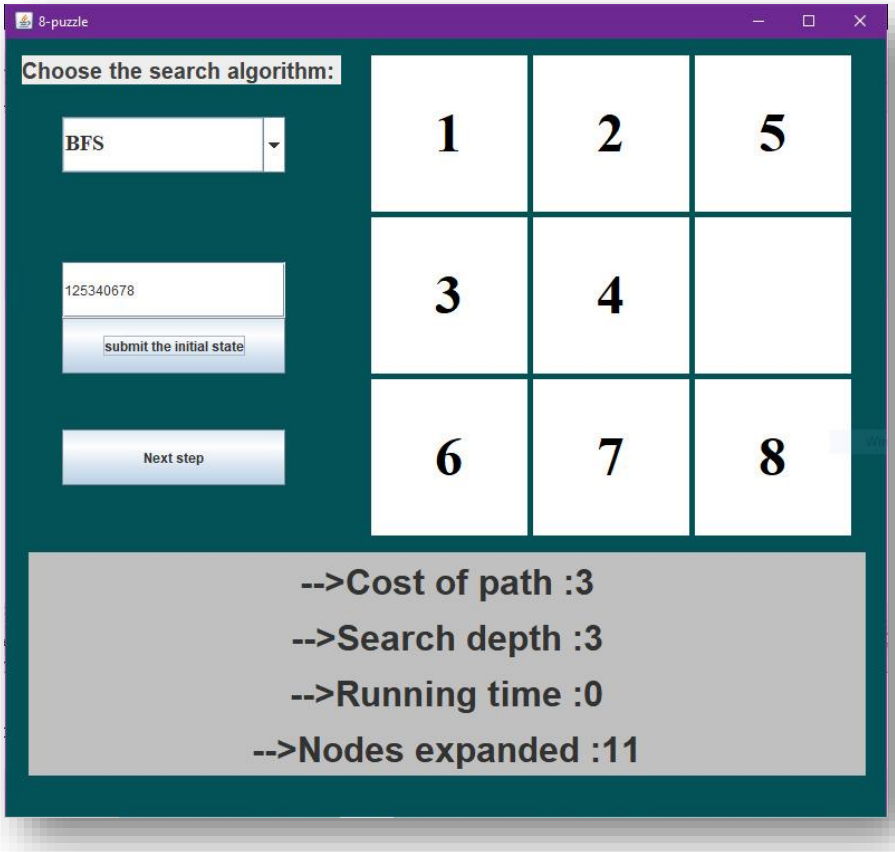
- There will be some states with unsolvable or not valid conditions.

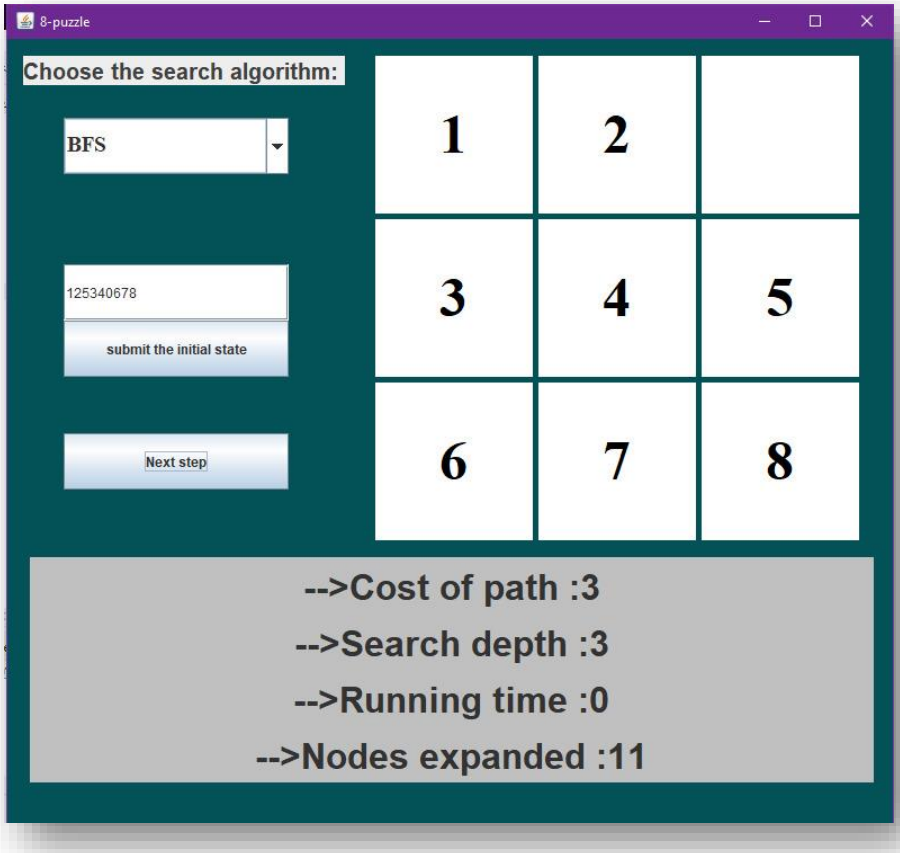
Sample runs:

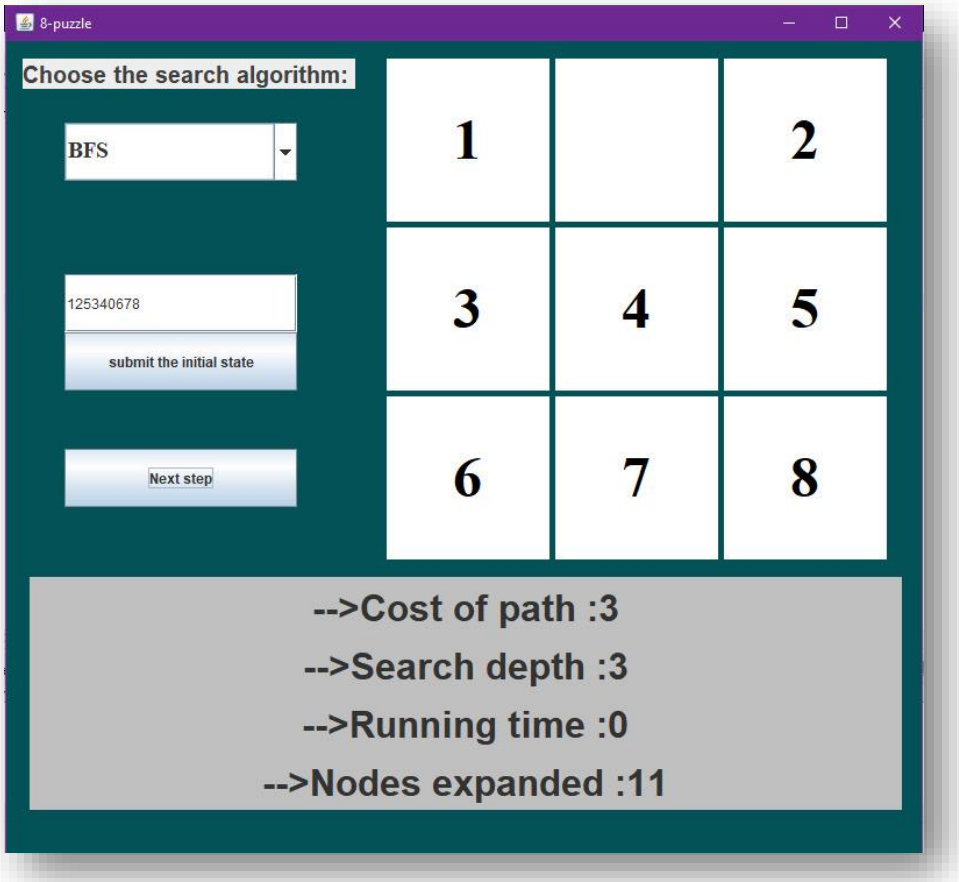
- Starting with an already solved puzzle (goal state):

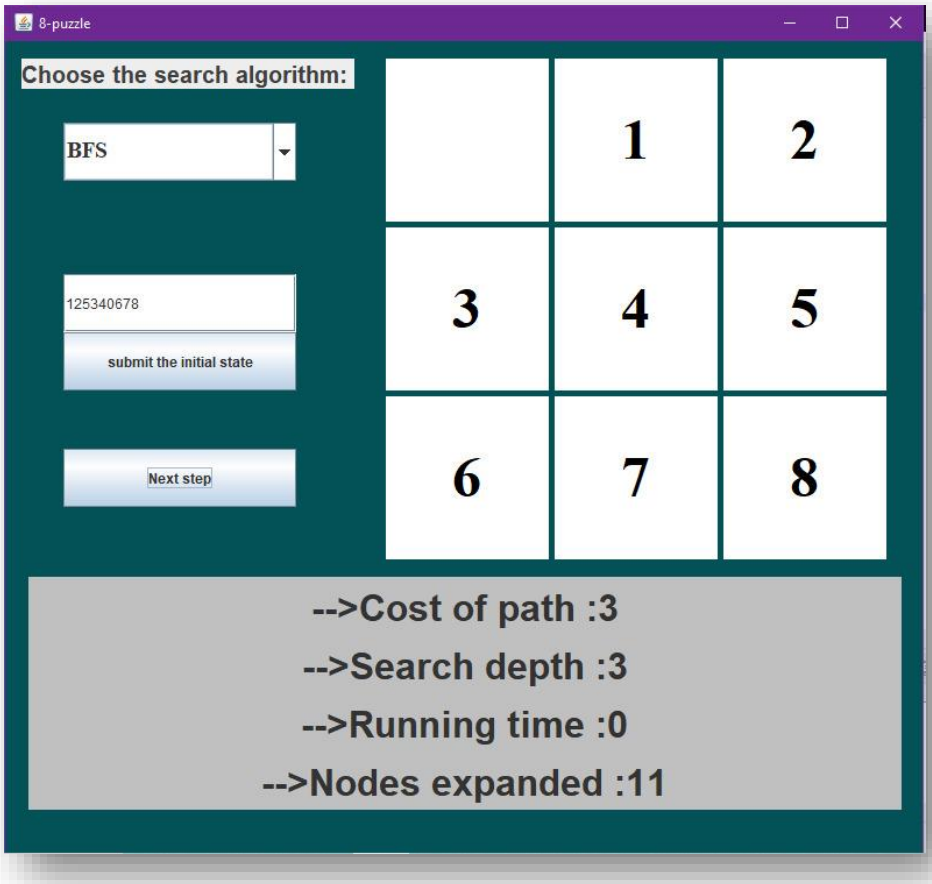


- BFS example(with simulation):

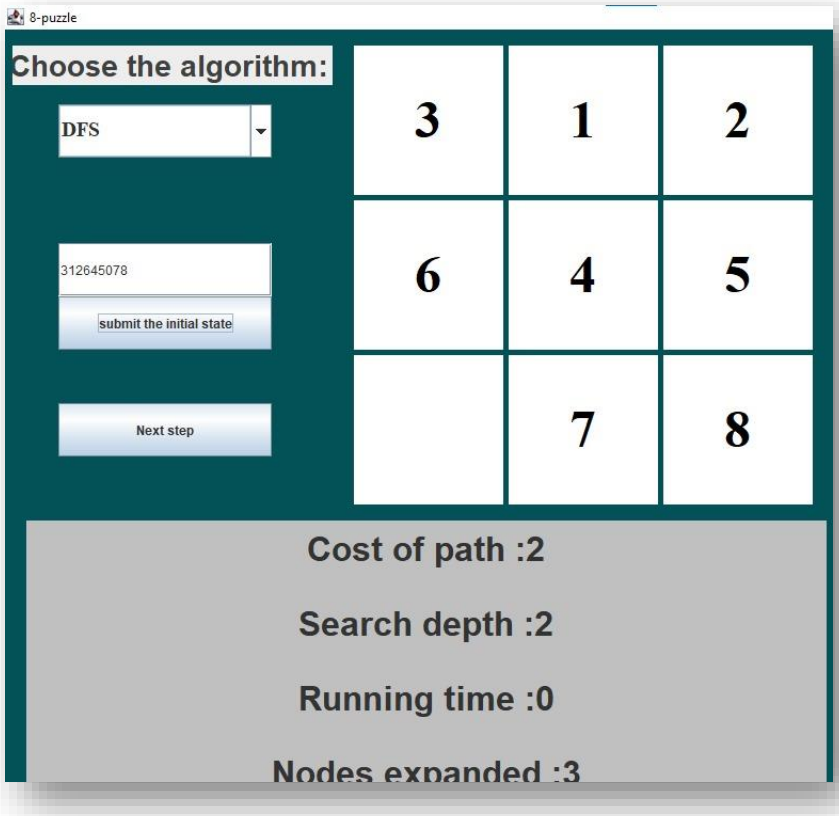


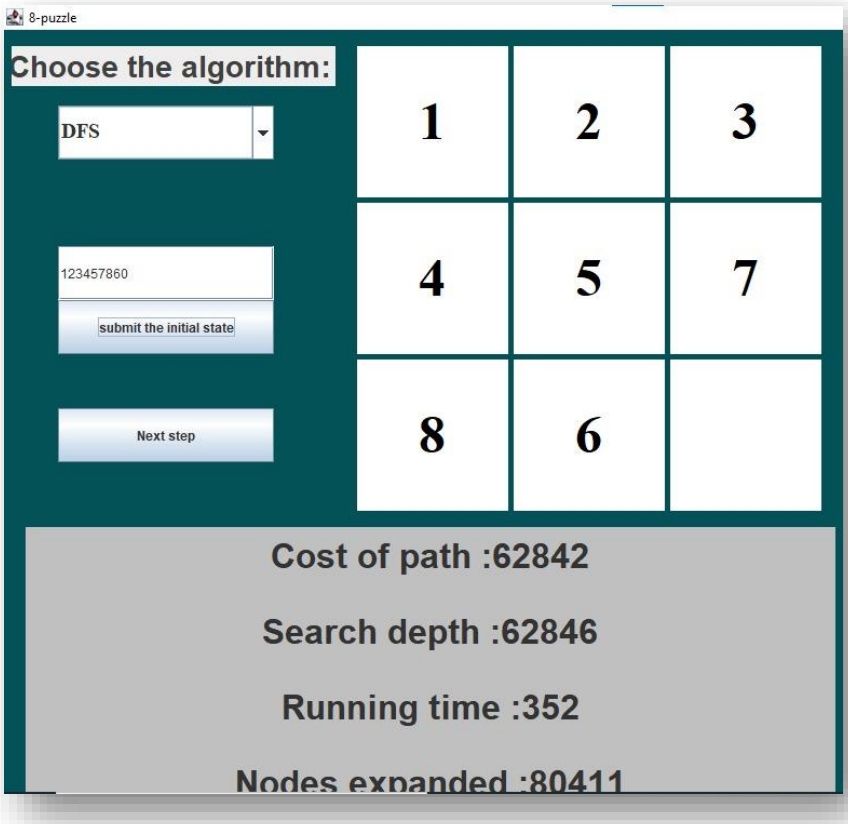



8-puzzle
Choose the search algorithm:
BFS
125340678
submit the initial state
Next step
1
2
3
4
5
6
7
8
-->Cost of path :3
-->Search depth :3
-->Running time :0
-->Nodes expanded :11

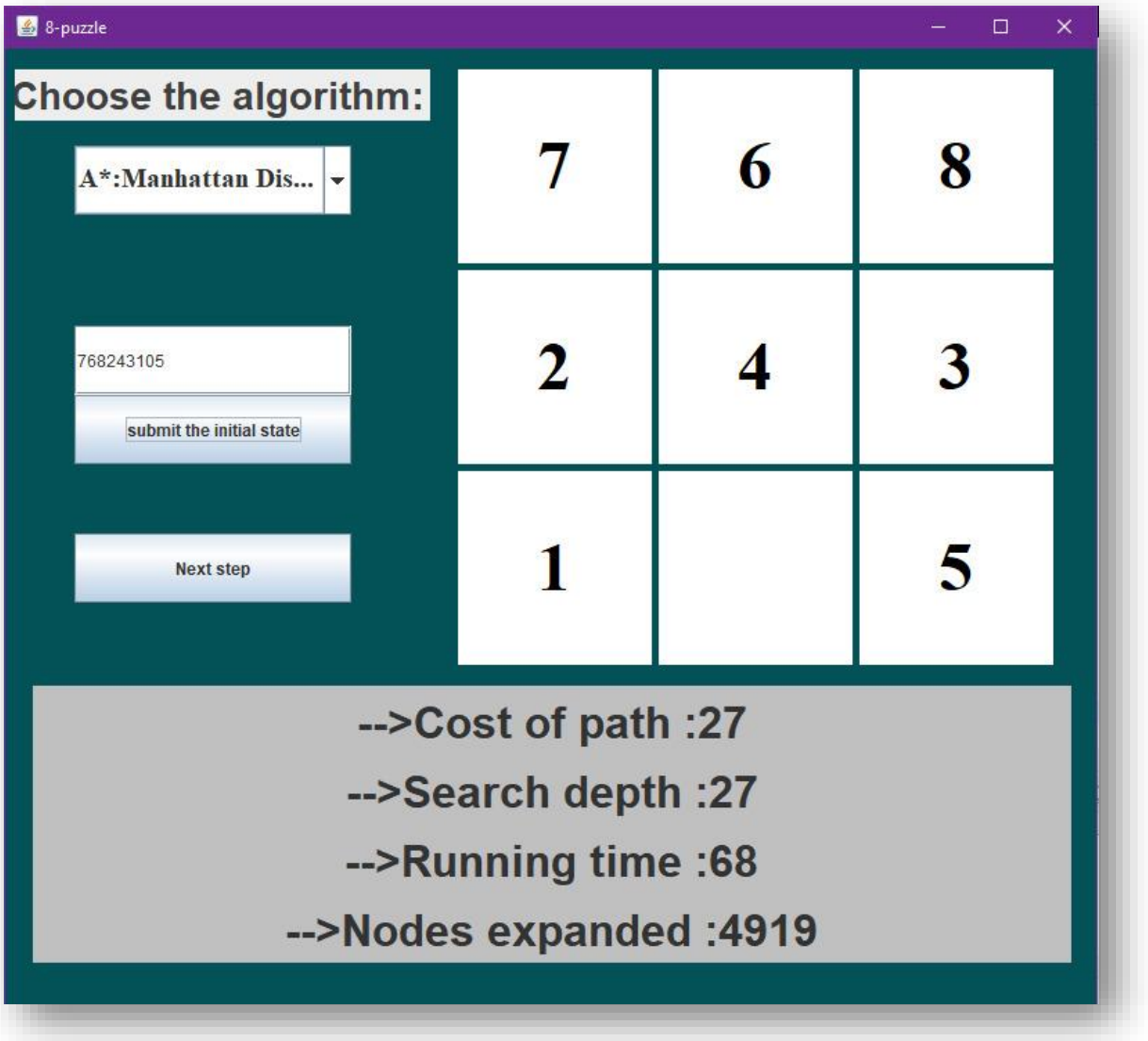

8-puzzle
Choose the search algorithm:
BFS
125340678
submit the initial state
Next step
1
2
3
4
5
6
7
8
-->Cost of path :3
-->Search depth :3
-->Running time :0
-->Nodes expanded :11

- DFS example (Base example up-up):

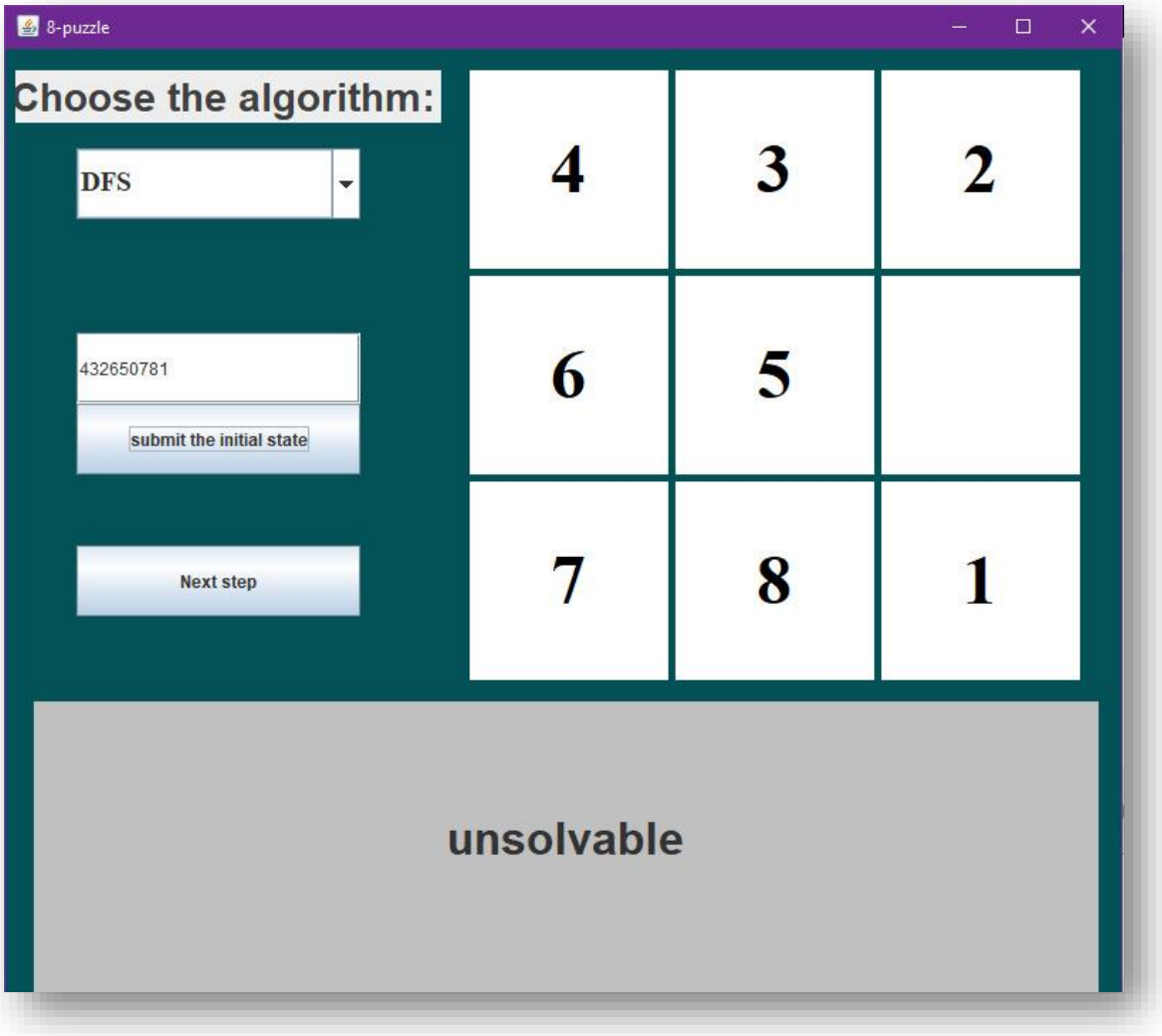




- A* example :


8-puzzle
Choose the algorithm:
A*:Manhattan Dis...
768243105
submit the initial state
Next step
7
6
8
2
4
3
1
5
-->Cost of path :27
-->Search depth :27
-->Running time :68
-->Nodes expanded :4919

- Unsolvable example:



- Not valid situation :