

**CS 461 - Program 1 Report**  
**Binh Nguyen - 16168354**

**8-puzzle problem**

**Goal State:**   1 2 3  
                  4 5 6  
                  7 8 E

**Method:** A\* search using manhattan distance heuristic

**References**

1. <https://www.geeksforgeeks.org/check-instance-8-puzzle-solvable>
2. <https://github.com/salimt/alg4-princeton/tree/master/8%20Puzzle>
- 3.

**Main classes:**

*Node.java class:*

- Implement Comparable<Node> to override the compare function based on heuristic cost (for Priority Queue to work).
- Variables:
  - parent node
  - sliding action for the empty tile
  - coordinates of the empty tile
  - current puzzle state
  - Manhattan heuristic cost
- Has getters, setters, constructors and some other functions.

*Utils.java class:*

- Has helpers functions for reading & processing inputs
- Has related functions for A\* search

*EightPuzzle.java class (Main program):*

- Process the input datafile into a list of puzzles
- Loop through the puzzle list and apply A\* search
- For every puzzle, report the solution whether there is a solution

**Main Data Structures:** Priority Queue & Hash Set for A\* Search, 2D char array for puzzle state.

**Running Instruction:** Open the project under IntelliJ IDE, build & run EightPuzzle.java Module.

Screenshots:

```
***** 8-PUZZLE WITH A* MANHATTAN HEURISTIC *****

Current files in our input directory:
  [1] prog1_input.txt
  [2] .DS_Store

Please select an option from [1] to [2]: 1

You have selected the following file: prog1_input.txt
Number of puzzles: 10

* Puzzle #1:

7 5 4
3 6 2
E 8 1

=> This puzzle is not solvable!

* Puzzle #2:

2 1 8
4 3 5
E 6 7

=> This puzzle is not solvable!

* Puzzle #3:

4 2 E
5 1 6
7 3 8

=> Slide a tile RIGHT to E <=
```

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

⇒ Slide a tile UP to E ⇐

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

⇒ PUZZLE SOLVED!!!

\* Puzzle #9:

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

⇒ This puzzle is not solvable!

\* Puzzle #10:

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

⇒ This puzzle is not solvable!