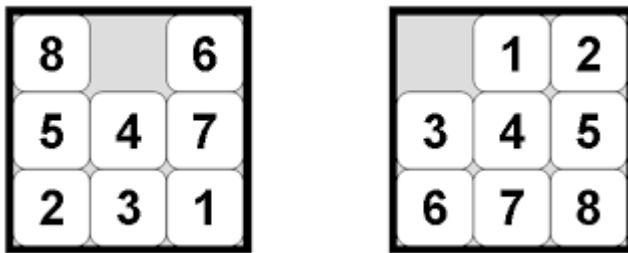


## Project #1

### Description

In this project you will implement and test various heuristics for the 8puzzle game. You will learn about efficient search.



For this:

1. Copy/clone this [directory](#). It contains a module for modelling the game (`eightpuzzle.py`) as well as a generic search module (`search.py`).
2. Make sure you have python 3 installed
3. cd to `8puzzle` folder and run the game using `python eightpuzzle.py` You should be getting something like this

```
Directory of C:\Users\Rachidi\Pacman\Pacman\8puzzle
9/06/2023 11:55 <DIR> .
9/06/2023 11:55 <DIR> ..
9/06/2023 11:52 9,057 eightpuzzle.py
9/06/2023 11:06 8,666 search.py
9/06/2023 11:38 26,709 util.py
3 File(s) 44,432 bytes
2 Dir(s) 20,932,562,944 bytes free

C:\Users\Rachidi\Pacman\Pacman\8puzzle>python eightpuzzle.py
A random puzzle:
-----
3 |  | 8 |
-----
5 | 2 | 1 |
-----
4 | 6 | 7 |
-----
* found a path of 13 moves: ['down', 'right', 'up', 'left', 'down', 'left', 'down', 'right', 'right', 'up', 'left', 't', 'up']
after 1 move: down
-----
3 | 2 | 8 |
-----
5 |  | 1 |
-----
4 | 6 | 7 |
-----
```

4. Review the code in `eightpuzzle.py` and `search.py`
5. Read this [heuristics](#) document

6. Make the following changes (your tasks in this project):

### Task1. Implement 4 different heuristics h1, h2, h3, h4 for the 8puzzle

Implement the admissible heuristics h1, h2, h3, h4 and show that they work (i.e., solve the problem)

### Task 2. Comparing heuristics

To compare the admissible heuristics mentioned earlier (h1 to h4), you need to **automatically** generate a large number of initial states for the 8-puzzle and solve each one using all 4 heuristics. You may want to write a script (`automate.py`) that reads a configuration file (`scenarios.csv`), runs the configurations and records the results (depth, expanded nodes, fringe size)

Tabulate the results and use averages to decide on which heuristic is best.

### Task 3. Overall comparison between strategies

Use the best heuristic found in task 2, and this time compare it to bfs, dfs, etc.

### Task4. Extra Credit: Scale the project to NxN puzzle.

Make the necessary changes to adapt the project to NxN puzzle and rerun the automatic performance test of Tasks 2 and 3.

### Deliverables

Post your project on canvas as one zip file containing

1. a **pdf** document showing (i) the sections of code you added/deleted and (ii) execution traces that proves you made the changes, and the tabulated results/comparisons. **The REPORT MUST mention the name of your teammate.**
2. the `search.py` and `eightpuzzle.py` with the changes indicated by a starting comment `/*=====Start Change Task i=====*/` and an ending comment `/*=====End Change Task i=====*/`

**All members of a team are required to submit.**