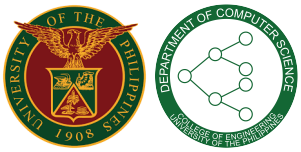
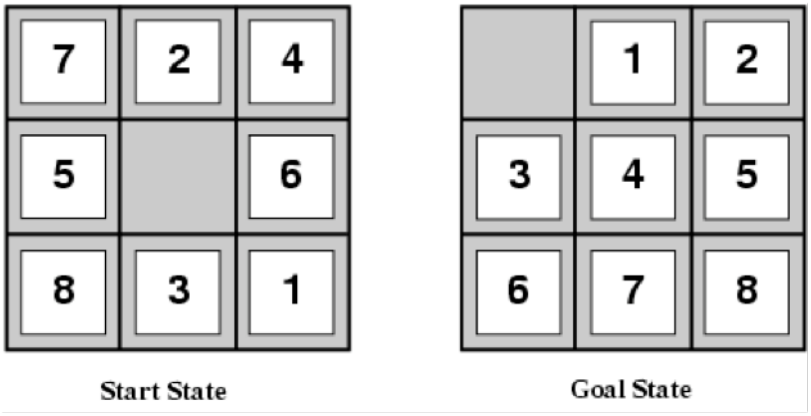


University of the Philippines, Diliman
College of Engineering
Department of Computer Science

CS 180 Machine Problem 1
N-Puzzle Solver

Introduction

An n-puzzle is a sliding puzzle that consists of a frame of numbered square tiles in random order with one tile missing. Popular sizes include a 3x3 board (shown below) and a 5x5 board. The objective of the puzzle is to place the tiles in order.



The optimal sequence of moves can be obtained using search. For this machine problem, use A* search to get a solution from the start to the goal board configuration.

Program Input

Your program must accept a filename as commandline argument. The file shall contain the start state, followed by the goal state. The blank tile shall be denoted by 0.

```
7 2 4
5 0 6
8 3 1
0 1 2
3 4 5
6 7 8
```

The size of the puzzle may vary from 3x3 to 7x7.

For simplicity, assume that the goal state is always reachable from the start state by some sequence of actions.

Program Output

Output through the terminal the optimal sequence of actions (up,down,left,right) to reach the goal state.

Heuristics

Use the following heuristic functions (`https://heuristicswiki.wikispaces.com/N+-+Puzzle`):

- Misplaced tiles
- Linear Conflict
- Tiles out of row and column
- Gaschnig's heuristic (N-maxswap)
- Manhattan distance

Analysis

Run your program on each of the provided test cases. Answer the following questions:

- For each of the test cases and heuristic functions, how many configurations were generated before arriving at a solution?
- Taking note of the specifications of your local computer, how much time did each run take?
- Prove the admissibility of the heuristic functions.
- Given your answers to the previous three questions, which of the three heuristics is the best fit for the problem?
- Run your program without any of the heuristics, by how much did the time and space requirements suffer?

Deliverables

Submit the following via email to `kedelaspenas@up.edu.ph` with subject *CS180 MP1 <SECTION> <Surname>*:

- Source code (Filename: *CS180MP1_<SECTION>_<Surname>.<ext>*)
- Analysis (Filename: *CS180MP1_<SECTION>_<Surname>.pdf*)

Deadline

The deadline of this machine problem is on 5PM 11 February 2018.

Notes

This machine problem can be solved using any programming language.

No library that implements the A* algorithm can be used.

Code plagiarism will be dealt with an automatic grade of 5.0 and a case filed to the student disciplinary council. Refrain from discussing solutions with your classmates and looking at available code online.