**Applied Artificial Intelligence**

Programming Assignment No 1 Fall 2024
Assigned on 13/09/2024 Deadline 20/09/2024 before 1:00 p.m.
Submission: GCR Weight 3% (implementation) + 1% (Report)

## Instructions:

Following rules will be enforced for this assignment

- You might work in a group of at most two students
- You might be asked to explain you approach and implementation details during a detailed evaluation.
- Late submission will be allowed but the following deductions will be applicable
    - 20 % deduction on submissions within 24 hours of the deadline
    - 50 % deduction for submissions that are more than 24 hours late but are within 48 hours of the deadline.
    - 100% deduction if more than 48 hour late.

**Please remember that PLAGIARISM is INTOLERABLE and anyone found involved in it will get -3 marks (i.e. 100% penalty) in this assignment.**

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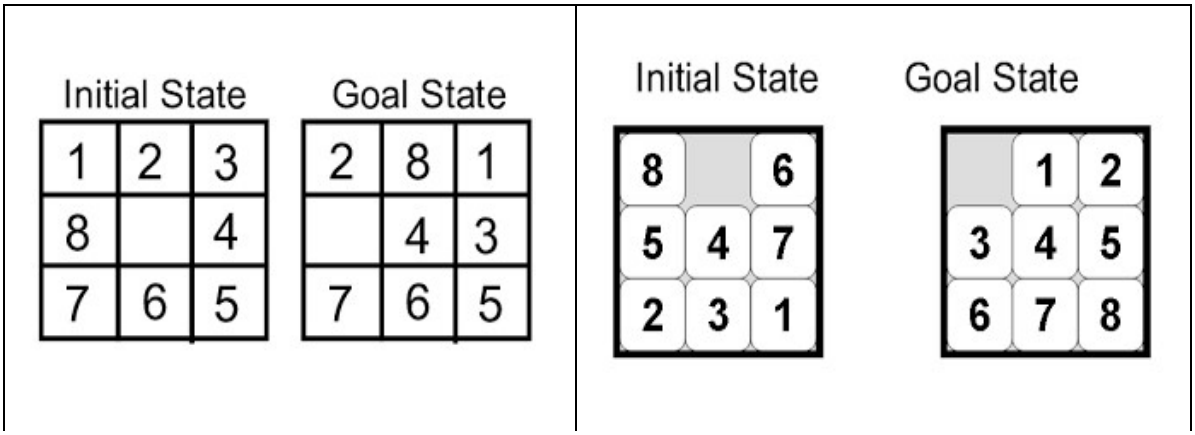
# ATTAIN APPARENT INTELLIGENCE BY SEARCHING THE STATE-SPACE

## Problem

The 8 and 15 puzzle problems are classic problems used to test any intelligent state-space search strategy. In this assignment we are going to implement A* algorithm to solve 3(2x2), 8(3x3), 15(4x4) and 24(5x5) puzzles. Two sample 8 puzzles are shown below




These puzzle, also known as the sliding puzzle, are classic problem where the objective is to arrange a set of numbered tiles in a specific order. Each puzzle consists of a 2x2, 3x3, 4x4 or 5x5 grids respectively with 3, 8, 15 and 24 numbered tiles and one empty space. Players can move tiles adjacent to the empty space into that gap or equivalently move the space into a horizontally or vertically adjacent location. The goal of this puzzle is to arrange the tiles in some pre-specified order (typically sorted order).
You can read more about these puzzles online or talk to chatGPT for more information.

This assignment requires you to implement A* algorithm that will be used to solve any of the 2x2, 3x3, 4x4, 5x5 tiles puzzle.

Your program will be provided name of a text file containing a set of **initial** and **final configuration pairs** and a limit **L** on the number of moves allowed. For each pair of configurations and limit your program must generate a set of at most **L** valid moves needed to transform the initial state into the final state or it must inform the user that no such sequence of moves exists.

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## File Format

The file will contain $2n^2 + 2$ non-negative integers. The first integer being the size of the puzzle, second being the maximum number of moves to solve the puzzle, next $n^2$ integers (a permutation of integers 0, 1, 2, …, $n^2 – 1$) specifying the initial state of the puzzle in row major order and remaining $n^2$ integers (another permutation of integers 0, 1, 2, …, $n^2 – 1$) specifying the final state of the puzzle in row major order. Here the integer 0 is used to code the space

Since we are software engineers therefore a proper design with decoupled from processing and a generic implementation so that the problem solver can be extended easily to solve other problems in future is also a core requirement.

Submission:

i) Code (In Python)
ii) Documentation of code
iii) Description of all necessary implementation details like Heuristic(s) used
iv) Results and statistics like time used to solve puzzles of varying difficulty