hugomcp@di.ubi.pt, 2022/23

Artificial Intelligence

Practical Sheet 2: [H x W] - Puzzle Solving

1. Define a data structure to store all the information about a [H x W] – Puzzle. This is a sliding puzzle with H x W - 1 pieces (plus one blank square), leaving one unoccupied tile position. Tiles in the same row or column of the open position can be moved by sliding them horizontally or vertically, respectively. The goal of the puzzle is to place the tiles in **numerical order**.

Example of a 4 x 4 Puzzle initial (random) state

3	5	12	11
15	1	6	10
7	13		4
8	14	2	9

Final (Goal) State

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	

2. Implement a Python function that creates a random initial valid state.

3. Implement a Python script that receives one initial (random) state and – using brute force search – returns the minimal number of moves required for reaching the goal state.

4. Obtain a 2D linear plot, relating the number of pieces in the board and the average minimal number of movements required to solve a puzzle.

5. Check if the shape of the board influences the average number of movements required to solve puzzles (i.e., "*is it harder to solve a 4 x 4 puzzle than an 8 x 2?*")

6. Obtain a linear plot, relating the proportion between the width and height ($p = \frac{w}{h}$) of the board ($\forall\, h, w \geq 2$) and the average number of movements required to solve puzzles.