**Offline 2: N puzzle with A-star algorithm**

Heuristics used for this assignment are-

1. Tiles out of row and column. (h1)
2. N-Max Swap (h2)

**Admissibility:**

The heuristic for N-Max Swap, or Gasching’s heuristic, h2 is the number of steps it would take to solve the problem if it was possible to swap any tile with the "space".

In the original problem, we can only swap the empty tile with another tile that’s directly adjacent to it horizontally or vertically.

But, in Gasching’s heuristic, we can swap the empty tile with any other tile. Hence, this is an easier problem.

And, this underestimates the actual distance function. Hence, this is admissible.

**Comparative performance:** (For 8 puzzle, 0 stands for the blank tile)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Start State | Goal State | Nodes Explored for h1 | Nodes Explored for h2 | Number of moves | Run time for h1 (s) | Run time for h2 (s) |
| 724631805 | 123456780 | 2495 | 9660 | 23 | 0.234 | 1.719 |
| 206134758 | 123456780 | 17 | 30 | 9 | 0.002 | 0.016 |
| 806547231 | 012345678 | 53559 | 83678 | 31 | 5.85 | 17.237 |
| 724506831 | 012345678 | 10330 | 27192 | 26 | 1.039 | 5.194 |
| 261078354 | 123456780 | 13836 | 20552 | 27 | 1.419 | 3.817 |