Lab – 03

8 puzzle using A* algorithm

A.] A* with misplaced tiles Heuristic

Logic:

- $g(n)$: Number of moves made to reach the current state.
- $h(n)$: Number of tiles which are not in their correct position as goal state.
- A* algorithm is used to explore node based on their total cost $f(n) = g(n) + h(n)$.
- A* choose states with fewer misplaced tiles [$h(n)$].

Algorithm:

1. Initialize priority queue with `start` state, $g(n) = 0$, and $h(n)$ as the number of misplaced tiles.
2. Repeat until goal is reach or empty queue
   → Pop the state with lowest $f(n)$ from queue.
   → If the state is goal, return the path.
   → If not mark the current state as visited.
   → All valid child states are generated by moving the blank tile [0].
   for each successor: Calculate $g(new) = g(current) + 1$.
   calculate $h(new)$ as number of misplaced tiles.
3. Return "Failed search" if no solution is found.

$$f(n) = g(n) + h(n)$$

1	2	3
8		4
7	6	5

g = 0	2	8	3
h = 5	1	6	4
f = 5		7	5

g = 1	2	8	3		2	8	3	g = 1
n = 5		6	4		1	6	4	h = 4
f = 6	1	7	5			7	5	f = 15

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g = 2	2	8	3		2	8	3	g = 2
h = 3	1		4		1	6	4	h = 5
f = 5	7	6	5			5		f = 7

g = 3	2		3		2	8	3	g = 3
n = 3	1	8	4		1		4	h = 4
f = 6	7	6	5		7	6	5	h = 7

g = 4		2	3			2	3	g = 4
h = 2	1	8	4		1	8	4	h = 4
f = 6	7	6	5		7	6	5	f = 3

g = 5	1	2	3		1	2		g = 5
h = 1		8	4			8	4	h = 3
f = 6	7	6	5		7	6	5	f = 8

g = 6	1	2	3		1	2	3	g = 6
h = 2	7	8	4		8		4	h = 0 ⇒ Goal state
f = 8		6	5		7	6	5	f = 6

Total path cost = 6