Assignment 4

A* Algorithm

⇒ **Problem Statement**: Solve 8-puzzle problem using A* Algorithm.

⇒ **Theory**:

A* Algorithm

- This algorithm is one of the best and popular technique used for path finding and graph traversal.
- A lot of games and web based map use this algorithm for finding the shortest path efficiently
- It is essentially a best first search algorithm.

⇒ **Working**:

A* algorithm works as -

1) It maintains a tree of paths originating at the start node
2) It extends those paths, one edge at a time.
3) It continues until its termination criterion is satisfied.

A* Algorithm extends the path that minimize the following function:

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

Here,

- 'n' is the last node on the path.
- g(n) is the actual cost of the path from start node to node 'n'.
- h(n) is a heuristic function that estimates cost of the cheapest path from node 'n' to the goal node.

⇒ Problem: The 8 puzzle problem

The goal of the puzzle is to rearrange the blocks so that they are in order of the final state. The blank tile can sometimes be at the end. The diagram shows one possible initial configuration and the goal. You are permitted to slide block horizontally or vertically into the blank square to reach the goal state. This has to be done in minimum number of steps.

h(n) = misplaced tiles = 4

2	8	3
1	6	4
7		5

Initial State

1	2	3
8		4
7	6	5

Final State

- Algorithm:

1) Consider g(n) = depth of node
   and h(n) = number of misplaced tiles
2) A* algorithm maintains a tree of path originating at the initial state.
3) It extends those paths one edge at a time.
4) It continues until final state is reached.

⇒ Conclusion: 8-puzzle problem was implemented successfully using A* Algorithm.