AI Assignment - 3

Niraj Milind Amrutkar
Roll No. 232002
Batch - B1

Aim : Implementation of A^* Algorithm (always gives optimal solution) for solving puzzle problems.

Theory :

A^* is a computer algorithm that is widely used in path finding & graph traversal. The process of plotting an efficiently traversable path b/w multiple points called Nodes. Noted for its performance & accuracy, it enjoys widespread use.

They key feature of the A^* algorithm is that it keeps track of each visited node which helps in ignoring the nodes that are already visited saving a huge amount of time. It also has a list that holds all the nodes that are left to be explored & it chooses the most optimal node from the list thus saving time not exploring unnecessary or less optimal nodes in graph/tree.

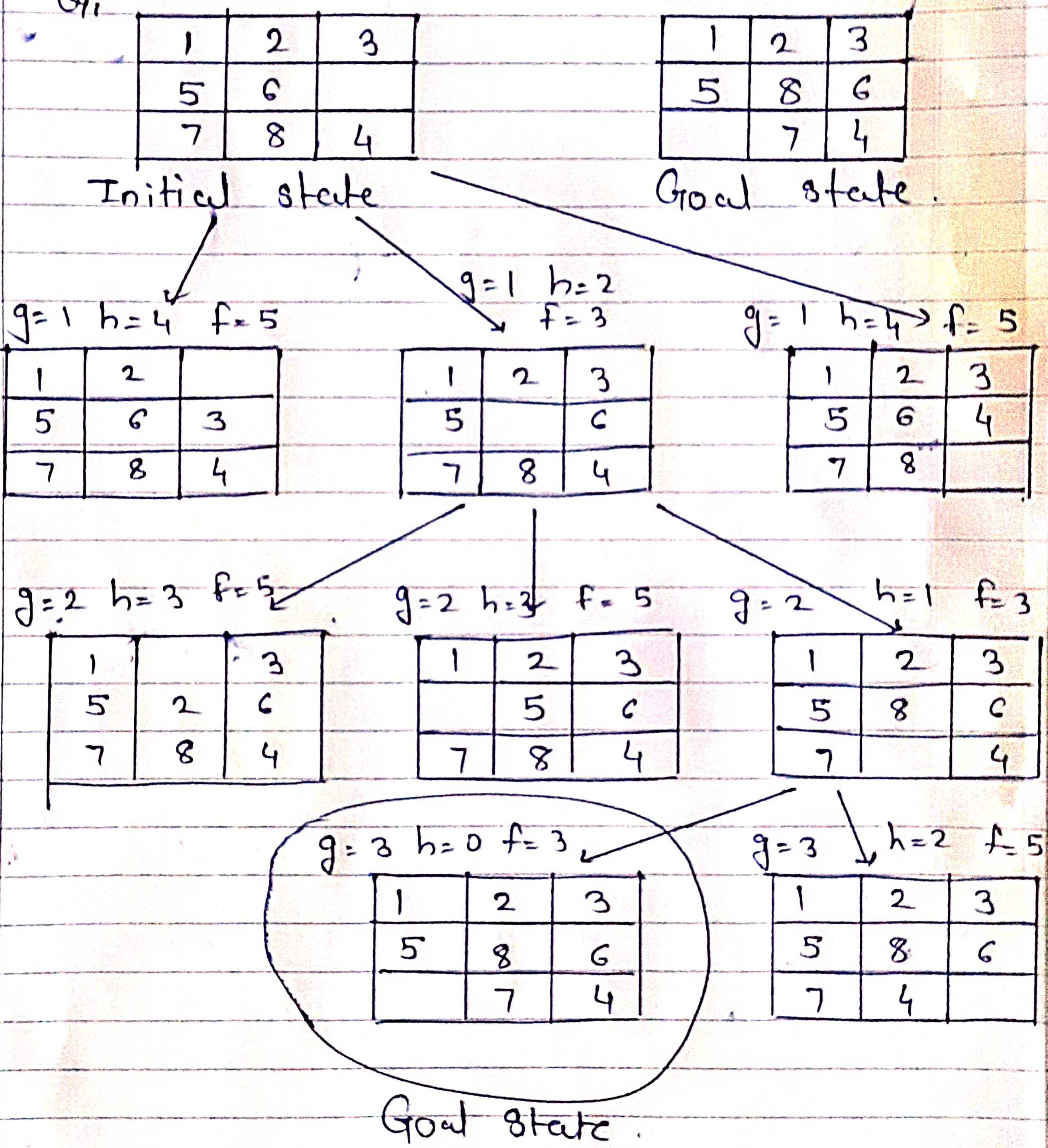
So, we use two lists, namely, 'open list' and 'closed list'. The open list contains all nodes that are being generated & are not existing in the closed list and each node explored after its neighbouring nodes are discovered is put in the closed list and the neighbours are put in the open list this is how the nodes expand Each node has a pointer to its parent so that at any given point it can retrace the path to the parent. Initially the open list holds the start node. the next node choosen from the open list is based on its f-score, the node with the least f-score is picked up & explored.

$$f\text{-}Score = H_{score} + g_{score}$$

A* uses a combination of the heuristic value (h-score : how far the goal node is) as well as the (g-score the no. of nodes traversed from the start node to current node).

8 puzzle problem using A* :

e.g. Q11



1	2	3
5	6	
7	8	4

Initial state

1	2	3
5	8	6
	7	4

Goal state.

g=1 h=4 f=5

1	2	
5	6	3
7	8	4

g=1 h=2 f=3

1	2	3
5		6
7	8	4

g=1 h=4 f=5

1	2	3
5	6	4
7	8	

g=2 h=3 f=5

1		3
5	2	6
7	8	4

g=2 h=3 f=5

1	2	3
	5	6
7	8	4

g=2 h=1 f=3

1	2	3
5	8	6
7		4

g=3 h=0 f=3

1	2	3
5	8	6
	7	4

Goal state.

g=3 h=2 f=5

1	2	3
5	8	6
7	4	