Program 5

Implement the 8-puzzle problem using A* algorithm,using Heuristic function as Manhattan distance with depth not more than 3.If goal state is not reached within this limit,agent must report “NOSOLUTION”.

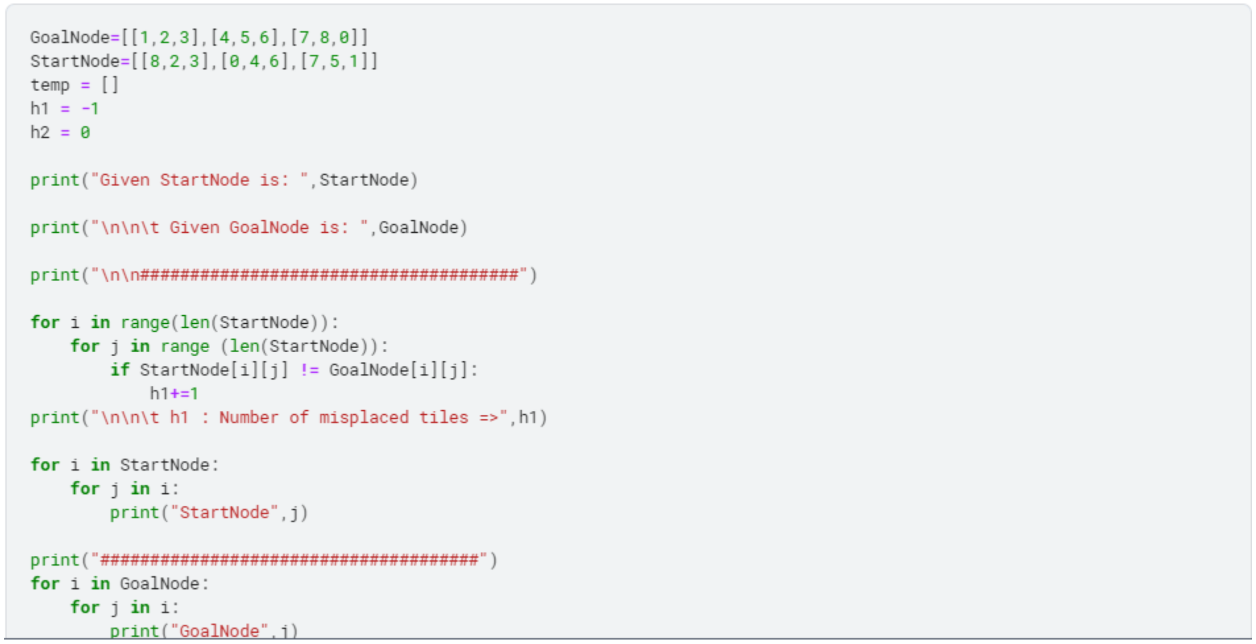
8	2	3
	4	6
7	5	1

Initial state

8	2	3
	4	6
7	5	1

Goal state

Code:



```
GoalNode=[[1,2,3],[4,5,6],[7,8,0]]
StartNode=[[8,2,3],[0,4,6],[7,5,1]]
temp = []
h1 = -1
h2 = 0

print("Given StartNode is: ",StartNode)

print("\n\n\t Given GoalNode is: ",GoalNode)

print("\n\n######################################")

for i in range(len(StartNode)):
    for j in range (len(StartNode)):
        if StartNode[i][j] != GoalNode[i][j]:
            h1+=1
print("\n\n\t h1 : Number of misplaced tiles =>",h1)

for i in StartNode:
    for j in i:
        print("StartNode",j)

print("######################################")
for i in GoalNode:
    for j in i:
        print("GoalNode",j)
```

```python
print("######################################")
for i in range(len(StartNode)):
    for j in range (len(StartNode)):
        print("i is ",i,"j is :",j)

print("\n\n######################################")

print("\n\nDistances of the tiles from their goal positions are: \n")

for i in range(len(StartNode)):
    for j in range (len(StartNode)):
        if (StartNode[i][j]==0):
            pass
        else:
            if (GoalNode[0][0] == StartNode[i][j]):
                temp.append(abs(i-0) + abs(j-0))
                print("\t",temp)

            elif (GoalNode[0][1] == StartNode[i][j]):
                temp.append(abs(i-0) + abs(j-1))
                print("\t",temp)
            elif (GoalNode[0][2] == StartNode[i][j]):
                temp.append(abs(i-0) + abs(j-2))
                print("\t",temp)
            elif (GoalNode[1][0] == StartNode[i][j]):
                temp.append(abs(i-1) + abs(j-0))
                print("\t",temp)
            elif (GoalNode[1][1] == StartNode[i][j]):
                temp.append(abs(i-1) + abs(j-1))
```

```python
            elif (GoalNode[0][2] == StartNode[i][j]):
                temp.append(abs(i-0) + abs(j-2))
                print("\t",temp)
            elif (GoalNode[1][0] == StartNode[i][j]):
                temp.append(abs(i-1) + abs(j-0))
                print("\t",temp)
            elif (GoalNode[1][1] == StartNode[i][j]):
                temp.append(abs(i-1) + abs(j-1))
                print("\t",temp)
            elif (GoalNode[1][2] == StartNode[i][j]):
                temp.append(abs(i-1) + abs(j-2))
                print("\t",temp)
            elif (GoalNode[2][0] == StartNode[i][j]):
                temp.append(abs(i-2) + abs(j-0))
                print("\t",temp)
            elif (GoalNode[2][1] == StartNode[i][j]):
                temp.append(abs(i-2) + abs(j-1))
                print("\t",temp)
            elif (GoalNode[2][2] == StartNode[i][j]):
                temp.append(abs(i-2) + abs(j-2))
                print("\t",temp)
            else:
                print("Warning!!! This is for 8-puzzle program.So, don't cross the array limit.")


print("\n\n######################################")

for i in range(len(temp)):
    h2+=temp[i]
```

```
                temp.append(abs(i-2) + abs(j-2))
                print("\t",temp)
            else:
                print("Warning!!! This is for 8-puzzle program.So, don't cross the array limit.")


print("\n\n######################################")

for i in range(len(temp)):
    h2+=temp[i]
print("\nh2 :  The sum of the distances of the tiles from their goal positions =>",h2)

h=h1+h2

print("\n\n\tSo, the instance of given 8-puzzle solution is",h,"steps long.")
```

Output:

```
Given StartNode is:  [[8, 2, 3], [0, 4, 6], [7, 5, 1]]


        Given GoalNode is:  [[1, 2, 3], [4, 5, 6], [7, 8, 0]]


######################################


        h1 : Number of misplaced tiles => 4
StartNode 8
StartNode 2
StartNode 3
StartNode 0
StartNode 4
StartNode 6
StartNode 7
StartNode 5
StartNode 1
######################################
GoalNode 1
GoalNode 2
GoalNode 3
GoalNode 4
GoalNode 5
GoalNode 6
GoalNode 7
GoalNode 8
GoalNode 0
######################################
i is  0 j is : 0
i is  0 j is : 1
i is  0 j is : 2
```

```
GoalNode 6
GoalNode 7
GoalNode 8
GoalNode 0
######################################
i is  0 j is : 0
i is  0 j is : 1
i is  0 j is : 2
i is  1 j is : 0
i is  1 j is : 1
i is  1 j is : 2
i is  2 j is : 0
i is  2 j is : 1
i is  2 j is : 2


######################################


Distances of the tiles from their goal positions are:

         [3]
         [3, 0]
         [3, 0, 0]
         [3, 0, 0, 1]
         [3, 0, 0, 1, 0]
         [3, 0, 0, 1, 0, 0]
         [3, 0, 0, 1, 0, 0, 1]
         [3, 0, 0, 1, 0, 0, 1, 4]


######################################

h2 :  The sum of the distances of the tiles from their goal positions => 9


        So, the instance of given 8-puzzle solution is 13 steps long.
```