Program-5:

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

8 2 3
4 6
7 5 1

Start state

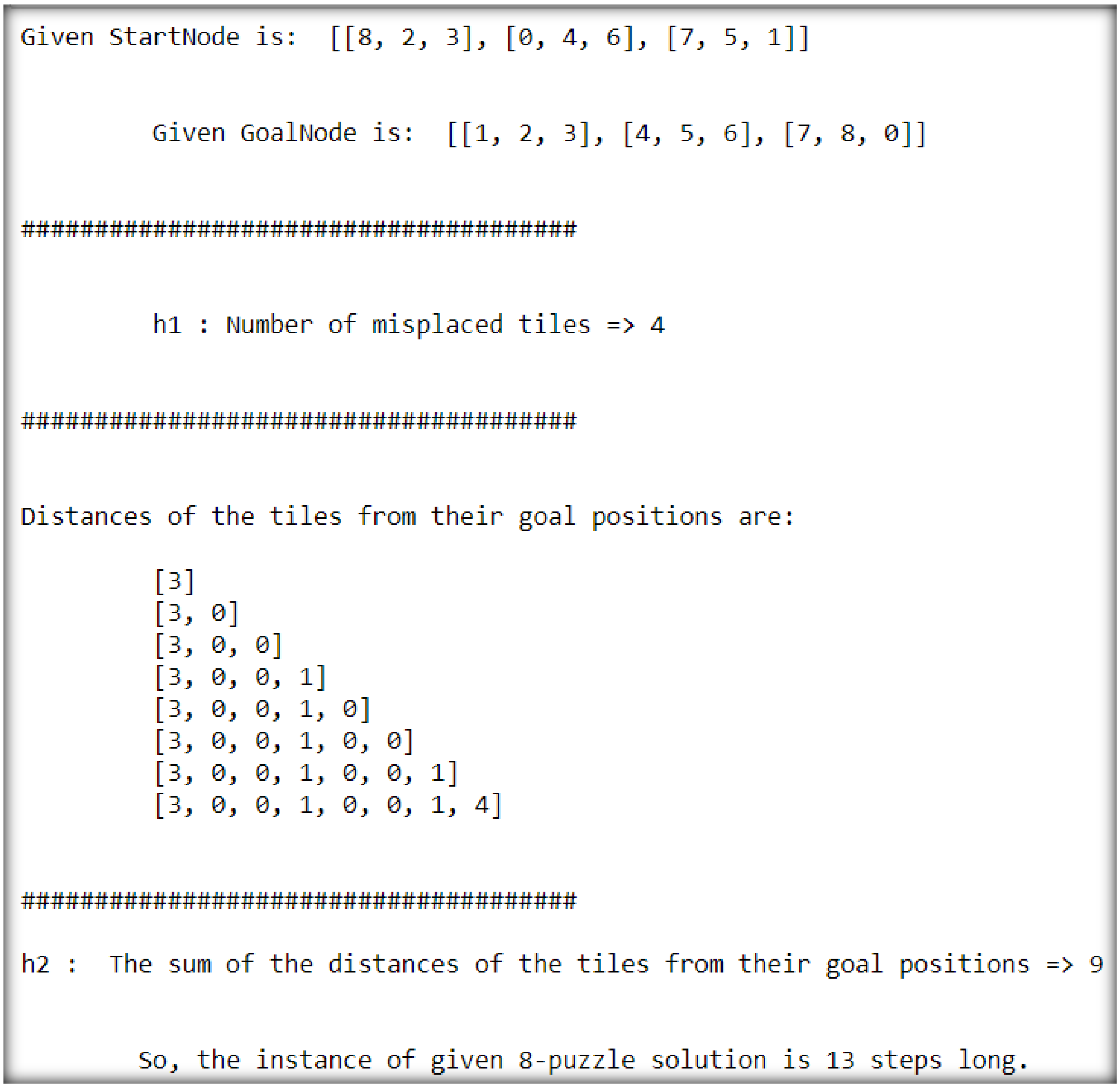
1 2 3
4 5 6
7 8
Goal State

```
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)
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))
        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("NO SOLUTION!!! 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.")
```

<u>Output:</u>



```
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


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


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.
```