**Assignment No. : 4**

**Name : Aniket B. Suryawanshi**

**Roll No : B-46**

**Subject : AI**

**Q)Implement 8 puzzle problem using A\* Algorithm.**

**Ans :**

**Code :**

class Node:

def \_\_init\_\_(self,data,level,fval):

""" Initialize the node with the data, level of the node and the calculated fvalue """

self.data = data

self.level = level

self.fval = fval

def generate\_child(self):

""" Generate child nodes from the given node by moving the blank space

either in the four directions {up,down,left,right} """

x,y = self.find(self.data,'\_')

""" val\_list contains position values for moving the blank space in either of

the 4 directions [up,down,left,right] respectively. """

val\_list = [[x,y-1],[x,y+1],[x-1,y],[x+1,y]]

children = []

for i in val\_list:

child = self.shuffle(self.data,x,y,i[0],i[1])

if child is not None:

child\_node = Node(child,self.level+1,0)

children.append(child\_node)

return children

def shuffle(self,puz,x1,y1,x2,y2):

""" Move the blank space in the given direction and if the position value are out

of limits the return None """

if x2 >= 0 and x2 < len(self.data) and y2 >= 0 and y2 < len(self.data):

temp\_puz = []

temp\_puz = self.copy(puz)

temp = temp\_puz[x2][y2]

temp\_puz[x2][y2] = temp\_puz[x1][y1]

temp\_puz[x1][y1] = temp

return temp\_puz

else:

return None

def copy(self,root):

""" Copy function to create a similar matrix of the given node"""

temp = []

for i in root:

t = []

for j in i:

t.append(j)

temp.append(t)

return temp

def find(self,puz,x):

""" Specifically used to find the position of the blank space """

for i in range(0,len(self.data)):

for j in range(0,len(self.data)):

if puz[i][j] == x:

return i,j

class Puzzle:

def \_\_init\_\_(self,size):

""" Initialize the puzzle size by the specified size,open and closed lists to empty """

self.n = size

self.open = []

self.closed = []

def accept(self):

""" Accepts the puzzle from the user """

puz = []

for i in range(0,self.n):

temp = input().split(" ")

puz.append(temp)

return puz

def f(self,start,goal):

""" Heuristic Function to calculate hueristic value f(x) = h(x) + g(x) """

return self.h(start.data,goal)+start.level

def h(self,start,goal):

""" Calculates the different between the given puzzles """

temp = 0

for i in range(0,self.n):

for j in range(0,self.n):

if start[i][j] != goal[i][j] and start[i][j] != '\_':

temp += 1

return temp

def process(self):

""" Accept Start and Goal Puzzle state"""

print("Enter the start state matrix \n")

start = self.accept()

print("Enter the goal state matrix \n")

goal = self.accept()

start = Node(start,0,0)

start.fval = self.f(start,goal)

""" Put the start node in the open list"""

self.open.append(start)

print("\n\n")

while True:

cur = self.open[0]

print("")

print(" | ")

print(" | ")

print(" \\\'/ \n")

for i in cur.data:

for j in i:

print(j,end=" ")

print("")

""" If the difference between current and goal node is 0 we have reached the goal node"""

if(self.h(cur.data,goal) == 0):

break

for i in cur.generate\_child():

i.fval = self.f(i,goal)

self.open.append(i)

self.closed.append(cur)

del self.open[0]

""" sort the opne list based on f value """

self.open.sort(key = lambda x:x.fval,reverse=False)

puz = Puzzle(3)

puz.process()

**Output :**

Enter the start state matrix

1 2 3

\_ 4 6

7 5 8

Enter the goal state matrix

1 2 3

4 5 6

7 8 \_

|

|

\'/

1 2 3

\_ 4 6

7 5 8

|

|

\'/

1 2 3

4 \_ 6

7 5 8

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1 2 3

4 5 6

7 \_ 8

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1 2 3

4 5 6

7 8 \_