PROGRAM TITLE 1

8-PUZZLE PROBLEM

AIM:

To write a python program to solve 8-puzzle problem.

PROCEDURE:

- The code implements the A* algorithm to solve the 8-Puzzle problem.
- It defines classes for priority queue and nodes to represent states.
- Functions are provided for calculating costs, creating new nodes, and printing matrices.
- A* search is performed iteratively, exploring possible moves until the goal state is reached.
- The main section initializes the puzzle states and invokes the solver function to find the solution.

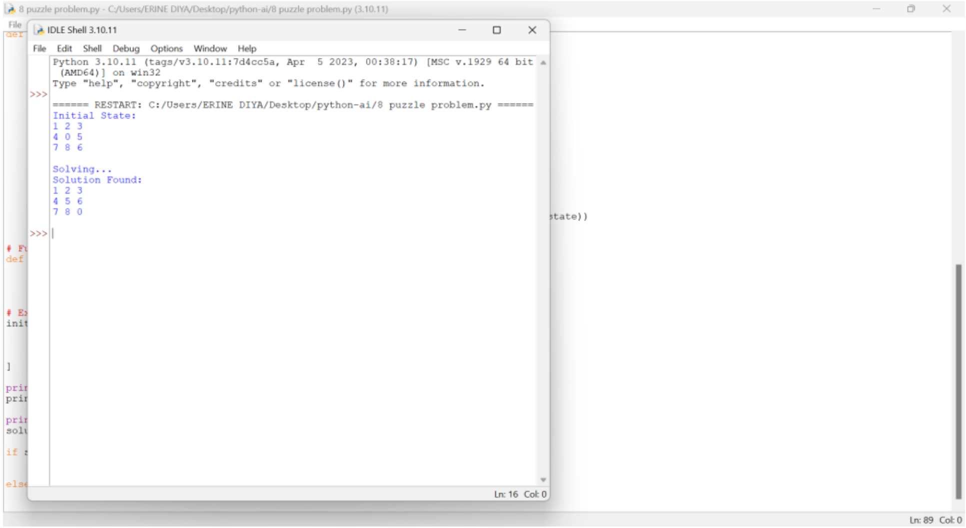
CODING:

```
import copy

from heapq import heappush, heappop


n = 3


row = [1, 0, -1, 0] col
= [0, -1, 0, 1]



class priorityQueue:


    def __init__(self):
self.heap = []


    def push(self, k):

        heappush(self.heap, k)
    def pop(self):

        return heappop(self.heap)



    def    empty(self):
if     not     self.heap:
return True        else:
            return False




class node:



    def __init__(self, parent, mat, empty_tile_pos,

                cost, level):
self.parent = parent


        self.mat = mat



        self.empty_tile_pos = empty_tile_pos



        self.cost = cost



        self.level = level



    def __lt__(self, nxt):

        return self.cost < nxt.cost




def calculateCost(mat, final) -> int:

    count = 0     for i in
range(n):         for j in
range(n):             if
((mat[i][j]) and
                    (mat[i][j] != final[i][j])):
```

```
                count += 1

    return count


def newNode(mat, empty_tile_pos, new_empty_tile_pos,

            level, parent, final) -> node:

    new_mat = copy.deepcopy(mat)

    x1 = empty_tile_pos[0]     y1 = empty_tile_pos[1]     x2 =
new_empty_tile_pos[0]     y2 = new_empty_tile_pos[1]     new_mat[x1][y1],
new_mat[x2][y2] = new_mat[x2][y2], new_mat[x1][y1]

    cost = calculateCost(new_mat, final)

    new_node = node(parent, new_mat, new_empty_tile_pos,

                    cost, level)

    return new_node


def printMatrix(mat):
for i in range(n):
for j in range(n):

            print("%d " % (mat[i][j]), end=" ")

print()


def isSafe(x, y):     return x >= 0 and x < n and
y >= 0 and y < n


def printPath(root):
if root == None:
        return


    printPath(root.parent)
printMatrix(root.mat)     print()



def solve(initial, empty_tile_pos, final):
pq = priorityQueue()


    cost = calculateCost(initial, final)
root = node(None, initial,
empty_tile_pos, cost, 0)


    pq.push(root)


    while not pq.empty():

        minimum = pq.pop()


        if minimum.cost == 0:
printPath(minimum)
            return


        for i in range(4):             new_tile_pos = [
minimum.empty_tile_pos[0] + row[i],
minimum.empty_tile_pos[1] + col[i], ]


            if isSafe(new_tile_pos[0], new_tile_pos[1]):
child = newNode(minimum.mat,
minimum.empty_tile_pos,
new_tile_pos,                              minimum.level +
1,                              minimum, final, )


                pq.push(child)
```

```
initial = [[1, 2, 3],
[5, 6, 0],
          [7, 8, 4]]


final = [[1, 2, 3],

        [5, 8, 6],

        [0, 7, 4]]


empty_tile_pos = [1, 2]


solve(initial, empty_tile_pos, final)
```

OUTPUT:



8 puzzle problem.py - C:/Users/ERINE DIYA/Desktop/python-ai/8 puzzle problem.py (3.10.11)
IDLE Shell 3.10.11
File Edit Shell Debug Options Window Help
Ln: 16 Col: 0
Ln: 89 Col: 0

```
Python 3.10.11 (tags/v3.10.11:7d4cc5a, Apr  5 2023, 00:38:17) [MSC v.1929 64 bit
 (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
====== RESTART: C:/Users/ERINE DIYA/Desktop/python-ai/8 puzzle problem.py ======
Initial State:
1 2 3
4 0 5
7 8 6

Solving...
Solution Found:
1 2 3
4 5 6
7 8 0

>>> 
```

RESULT:

Hence the program been successfully executed and verified.