

A * Algorithm

Find the path from A-G for the given graph by using A* algorithm.

Code:

```
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):

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

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

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```
empty_tile_pos = [ 2, 1 ]  
  
solve(initial, empty_tile_pos, final)
```

Output:

```
PS F:\IMP_DOCUMENT\College_material\SEM6\Artificial-Intelligence-Lab-Sem6> & C:/Users/LENOVO/AppData/Local/Programs/Python/Python310/python.exe "c:/Users/LENOVO/OneDrive - pdpu.ac.in/Desktop/test.py"  
2 8 3  
1 6 4  
7 0 5  
  
2 8 3  
1 0 4  
7 6 5  
  
2 0 3  
1 8 4  
7 6 5  
  
0 2 3  
1 8 4  
7 6 5  
  
1 2 3  
0 8 4  
7 6 5  
  
1 2 3  
8 0 4  
7 6 5
```