```python
# Python code to display the way from the root

# node to the final destination node for N*N-1 puzzle

# algorithm by the help of Branch and Bound technique

# The answer assumes that the instance of the

# puzzle can be solved


# Importing the 'copy' for deepcopy method

import copy


# Importing the heap methods from the python

# library for the Priority Queue

from heapq import heappush, heappop


# This particular var can be changed to transform

# the program from 8 puzzle(n=3) into 15

# puzzle(n=4) and so on ...

n = 3


# bottom, left, top, right

rows = [ 1, 0, -1, 0 ]

cols = [ 0, -1, 0, 1 ]


# creating a class for the Priority Queue

class priorityQueue:


    # Constructor for initializing a

    # Priority Queue

    def __init__(self):

        self.heap = []
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    # Inserting a new key 'key'
    def push(self, key):
        heappush(self.heap, key)

    # funct to remove the element that is minimum,
    # from the Priority Queue
    def pop(self):
        return heappop(self.heap)

    # funct to check if the Queue is empty or not
    def empty(self):
        if not self.heap:
            return True
        else:
            return False

# structure of the node
class nodes:

    def __init__(self, parent, mats, empty_tile_posi,
                costs, levels):

        # This will store the parent node to the
        # current node And helps in tracing the
        # path when the solution is visible
        self.parent = parent

        # Useful for Storing the matrix
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        self.mats = mats

        # useful for Storing the position where the
        # empty space tile is already existing in the matrix
        self.empty_tile_posi = empty_tile_posi

        # Store no. of misplaced tiles
        self.costs = costs

        # Store no. of moves so far
        self.levels = levels

    # This func is used in order to form the
    # priority queue based on
    # the costs var of objects
    def __lt__(self, nxt):
        return self.costs < nxt.costs

# method to calc. the no. of
# misplaced tiles, that is the no. of non-blank
# tiles not in their final posi
def calculateCosts(mats, final) -> int:

    count = 0
    for i in range(n):
        for j in range(n):
            if ((mats[i][j]) and
                (mats[i][j] != final[i][j])):
                count += 1
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    return count

def newNodes(mats, empty_tile_posi, new_empty_tile_posi,
            levels, parent, final) -> nodes:

    # Copying data from the parent matrixes to the present matrixes
    new_mats = copy.deepcopy(mats)

    # Moving the tile by 1 position
    x1 = empty_tile_posi[0]
    y1 = empty_tile_posi[1]
    x2 = new_empty_tile_posi[0]
    y2 = new_empty_tile_posi[1]
    new_mats[x1][y1], new_mats[x2][y2] = new_mats[x2][y2], new_mats[x1][y1]

    # Setting the no. of misplaced tiles
    costs = calculateCosts(new_mats, final)

    new_nodes = nodes(parent, new_mats, new_empty_tile_posi,
                costs, levels)
    return new_nodes

# func to print the N by N matrix
def printMatsrix(mats):

    for i in range(n):
        for j in range(n):
            print("%d " % (mats[i][j]), end = " ")
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        print()

# func to know if (x, y) is a valid or invalid
# matrix coordinates
def isSafe(x, y):

    return x >= 0 and x < n and y >= 0 and y < n

# Printing the path from the root node to the final node
def printPath(root):

    if root == None:
        return

    printPath(root.parent)
    printMatsrix(root.mats)
    print()

# method for solving N*N - 1 puzzle algo
# by utilizing the Branch and Bound technique. empty_tile_posi is
# the blank tile position initially.
def solve(initial, empty_tile_posi, final):

    # Creating a priority queue for storing the live
    # nodes of the search tree
    pq = priorityQueue()

    # Creating the root node
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costs = calculateCosts(initial, final)
root = nodes(None, initial,
          empty_tile_posi, costs, 0)

# Adding root to the list of live nodes
pq.push(root)

# Discovering a live node with min. costs,
# and adding its children to the list of live
# nodes and finally deleting it from
# the list.
while not pq.empty():

    # Finding a live node with min. estimatsed
    # costs and deleting it form the list of the
    # live nodes
    minimum = pq.pop()

    # If the min. is ans node
    if minimum.costs == 0:

        # Printing the path from the root to
        # destination;
        printPath(minimum)
        return

    # Generating all feasible children
    for i in range(n):
        new_tile_posi = [
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            minimum.empty_tile_posi[0] + rows[i],
            minimum.empty_tile_posi[1] + cols[i], ]

        if isSafe(new_tile_posi[0], new_tile_posi[1]):

            # Creating a child node
            child = newNodes(minimum.mats,
                        minimum.empty_tile_posi,
                        new_tile_posi,
                        minimum.levels + 1,
                        minimum, final,)

            # Adding the child to the list of live nodes
            pq.push(child)

# Main Code

# Initial configuration
# Value 0 is taken here as an empty space
initial = [ [ 1, 2, 3 ],
        [ 5, 6, 0 ],
        [ 7, 8, 4 ] ]

# Final configuration that can be solved
# Value 0 is taken as an empty space
final = [ [ 1, 2, 3 ],
      [ 5, 8, 6 ],
      [ 0, 7, 4 ] ]
```

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# Blank tile coordinates in the
# initial configuration
empty_tile_posi = [ 1, 2 ]

# Method call for solving the puzzle
solve(initial, empty_tile_posi, final)
```

output.

File Edit Shell Debug Options Window Help

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Python 3.11.6 (tags/v3.11.6:8b6ee5b, Oct  2 2023, 14:57:12) [MSC v.1935 64 bit (
AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>> 
= RESTART: C:/Users/9550449358/OneDrive/Desktop/ai/6.vaccum cleaning.py
Enter Location of Vacuum cleaner 2
Enter status of 25
Enter status of other room45
Initial Location Condition{'A': '0', 'B': '0'}
Vacuum is placed in location B
0
Location B is already clean.
No action 0
Location A is already clean.
GOAL STATE:
{'A': '0', 'B': '0'}
Performance Measurement: 0
>>> 
==== RESTART: C:/Users/9550449358/OneDrive/Desktop/ai/1.8 puzzle problem.py ====
1  2  3
5  6  0
7  8  4

1  2  3
5  0  6
7  8  4

1  2  3
5  8  6
7  0  4

1  2  3
5  8  6
0  7  4

>>> 
```

Ln: 35 Col: 0