Group Assignment # 2

AI

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Code :

```
# Python3 program to print the path from root
# node to destination node for N*N-1 puzzle
# algorithm using Branch and Bound
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)
```

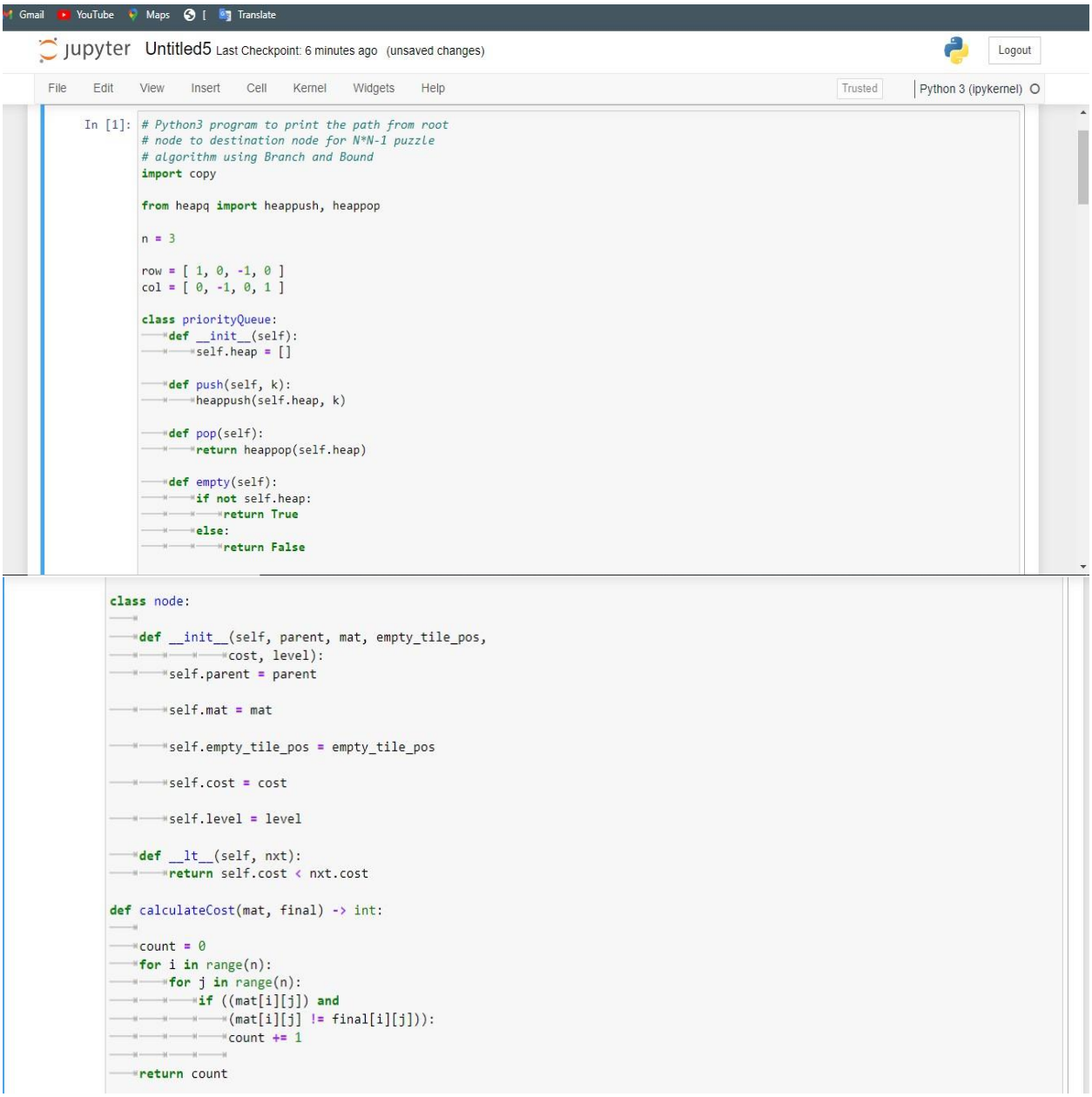
```

                                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)
```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Python 3 (ipykernel)
In [1]:
# Python3 program to print the path from root
# node to destination node for N*N-1 puzzle
# algorithm using Branch and Bound
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

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```
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
```

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```
def printPath(root):

    if root == None:
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    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)
```

Out Put:

```
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
```