LAB 3

8 Puzzle problem

CODE:

```
import copy

class Node:
   def __init__(self, state, parent=None, action=None, path_cost=0):
       self.state = state
       self.parent = parent
       self.action = action
       self.path_cost = path_cost

   def __lt__(self, other):
       return self.path_cost < other.path_cost

   def expand(self):
       children = []
       row, col = self.find_blank()
       possible_actions = []
       if row > 0:
           possible_actions.append('Up')
       if row < 2:
           possible_actions.append('Down')
       if col > 0:
           possible_actions.append('Left')
       if col < 2:
           possible_actions.append('Right')

       for action in possible_actions:
           new_state = copy.deepcopy(self.state)
           if action == 'Up':
               new_state[row][col], new_state[row - 1][col] =
new_state[row - 1][col], new_state[row][col]
           elif action == 'Down':
               new_state[row][col], new_state[row + 1][col] =
new_state[row + 1][col], new_state[row][col]
           elif action == 'Left':
```

```
                new_state[row][col], new_state[row][col - 1] =
new_state[row][col - 1], new_state[row][col]
            elif action == 'Right':
                new_state[row][col], new_state[row][col + 1] =
new_state[row][col + 1], new_state[row][col]
            children.append(Node(new_state, self, action, self.path_cost +
1))
        return children

    def find_blank(self):
        for row in range(3):
            for col in range(3):
                if self.state[row][col] == 0:
                    return row, col

def depth_first_search(initial_state, goal_state):
    frontier = [Node(initial_state)]
    explored = set()

    while frontier:
        node = frontier.pop()
        if node.state == goal_state:
            return node
        explored.add(tuple(map(tuple, node.state)))  # Convert the state to
a tuple of tuples

        for child in node.expand():
            child_state_tuple = tuple(map(tuple, child.state))
            if child_state_tuple not in explored:
                frontier.append(child)
    return None

def print_solution(node):
    path = []

    while node is not None:
        path.append((node.action, node.state))
        node = node.parent

    path.reverse()  # Reverse the path to start from the initial state
```

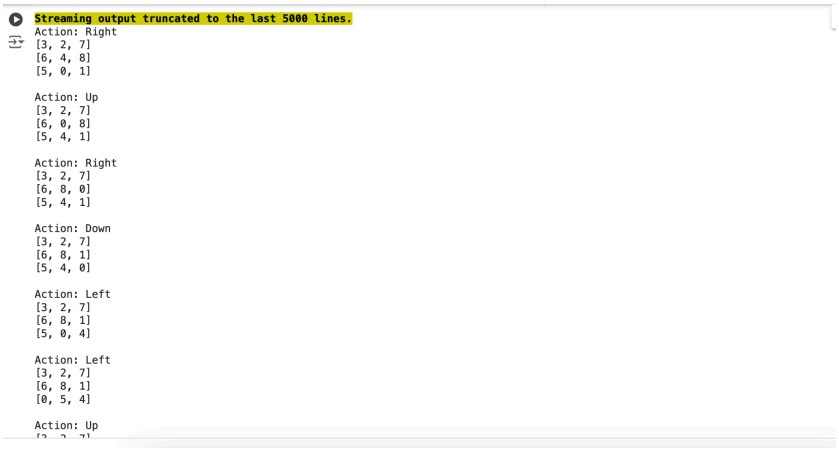
```
    for action, state in path:
        if action:
            print(f"Action: {action}")
        for row in state:
            print(row)
        print()

# Test the DFS with initial and goal states
initial_state = [[1, 2, 3], [0, 4, 6], [7, 5, 8]]
goal_state = [[1, 2, 3], [4, 5, 6], [7, 8, 0]]

solution = depth_first_search(initial_state, goal_state)

if solution:
    print("Solution found:")
    print_solution(solution)
else:
    print("Solution not found.")
```

OUTPUT:



8-PUZZLE PROBLEM

Algorithm:

Node class:

- Represents a state of the puzzle, including the current state, the parent node, the action taken to reach this state, and the path cost

expand():

generates child nodes by moving the blank tile (0) in possible directions.

find-blank():

locates the position of the blank tile in the state.

2. DFS:

- Initialize a stack (frontier) with the root node(initial state)
- Maintain a set(explored) to track visited state to avoid cycles.
- while there are nodes in frontier
  - → pop the last node from the stack
  - → If the current state matches the goal state return the node
  - → Add the current state to explored state
  - → expand the node to generate child nodes and add unvisited child states to the frontier.

3. solution path:

- If a solution is found, backtrack from the goal node to the initial node to extract the path of actions taken.
- Print the sequence of actions and the resulting states.

Stata Space tree 8 Puzzle Problem (DFS)