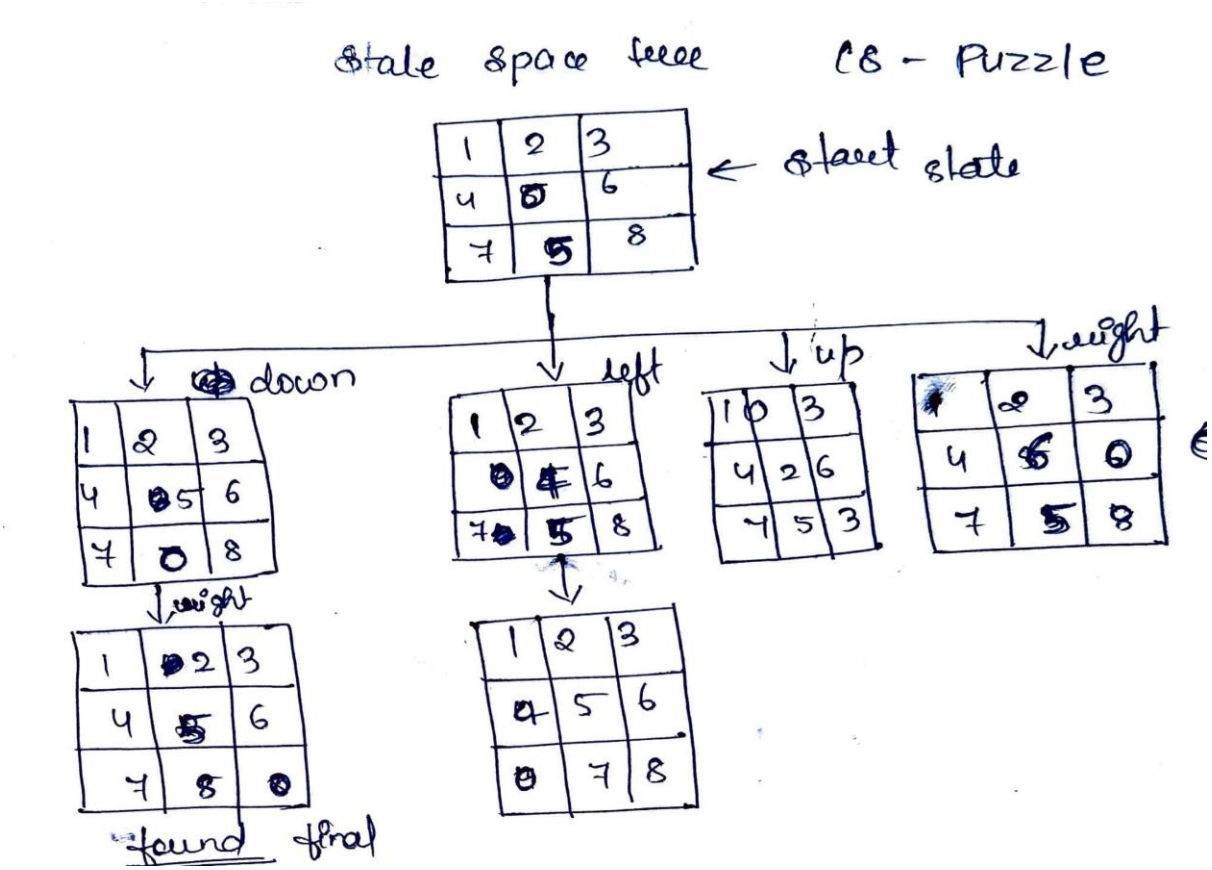
LAB PROGRAM 2

Solve 8 – Puzzle problems.



LAB-2

8 Puzzle Problem

```
import numpy as np

def bfs(src, target):
    queue = [(src, None)] # state and last move
    visited = set()
    state_count = 0  # Initialize state count

    while queue:
        state, last_move = queue.pop(0)
        state_tuple = tuple(state) # Convert state to
                                   tuple for set
        if state_tuple not in visited: operations
            visited.add(state_tuple)
            state_count += 1 # Increment the state
                               count

            print_board(state)
            if last_move:
                print(f"Current move: {last_move}\n")

            if state == target:
                print("Goal state achieved!")
                break

            for move, direction in possible_moves
                                   (state):
                if tuple(move) not in visited:
                    queue.append((move, direction))

print(f"Total unique states explored: {state_
                                   count}")
```

```
def possible_moves(state):
    b = state.index(0)
    directions = []
    if b not in [0, 1, 2]: directions.append('u')
    if b not in [6, 7, 8]: directions.append('d')
    if b not in [0, 3, 6]: directions.append('l')
    if b not in [2, 5, 8]: directions.append('r')
    return [(gen(state, d, b), d) for d in directions]

def gen(state, direction, b):
    temp = state.copy()
    if direction == 'u': temp[b], temp[b-3] = temp[b-3], temp[b]
    if direction == 'd': temp[b], temp[b+3] = temp[b+3], temp[b]
    if direction == 'l': temp[b], temp[b-1] = temp[b-1], temp[b]
    if direction == 'r': temp[b], temp[b+1] = temp[b+1], temp[b]

def print_board(state):
    board = np.array(state).reshape(3,3)
    print(board)

# Intial and target configuration
src = [1,2,3,0,4,5,6,7,8]
target = [1,2,3,4,5,6,7,8,0]

# Run bfs to solve the puzzle
bfs(src, target)
```

Code:

```
import numpy as np



def bfs(src, target):
    queue = [(src, None)]  # State and last move
    visited = set()
    state_count = 0  # Initialize state count



    while queue:
        state, last_move = queue.pop(0)
        state_tuple = tuple(state)  # Convert state to tuple for set operations

        if state_tuple not in visited:
            visited.add(state_tuple)
            state_count += 1  # Increment the state count



            print_board(state)
            if last_move:
                print(f"Current move: {last_move}\n")



            if state == target:
                print("Goal state achieved!")
                break



            for move, direction in possible_moves(state):
```

```
            if tuple(move) not in visited:
                queue.append((move, direction))


    print(f"Total unique states explored: {state_count}")


def possible_moves(state):
    b = state.index(0)
    directions = []

    if b not in [0, 1, 2]: directions.append('u')
    if b not in [6, 7, 8]: directions.append('d')
    if b not in [0, 3, 6]: directions.append('l')
    if b not in [2, 5, 8]: directions.append('r')


    return [(gen(state, d, b), d) for d in directions]


def gen(state, direction, b):
    temp = state.copy()
    if direction == 'u': temp[b], temp[b - 3] = temp[b - 3], temp[b]
    if direction == 'd': temp[b], temp[b + 3] = temp[b + 3], temp[b]
    if direction == 'l': temp[b], temp[b - 1] = temp[b - 1], temp[b]
    if direction == 'r': temp[b], temp[b + 1] = temp[b + 1], temp[b]
    return temp


def print_board(state):
```

```
    board = np.array(state).reshape(3, 3)
    print(board)


# Initial configuration and target configuration
src = [1, 2, 3, 0, 4, 6, 7, 5, 8]
target = [1, 2, 3, 4, 5, 6, 7, 8, 0]


# Run BFS to solve the puzzle
bfs(src, target)
```

Output:

```
[[1 2 3]
 [0 4 6]
 [7 5 8]]
[[0 2 3]
 [1 4 6]
 [7 5 8]]
Current move: u

[[1 2 3]
 [7 4 6]
 [0 5 8]]
Current move: d

[[1 2 3]
 [4 0 6]
 [7 5 8]]
Current move: r

[[2 0 3]
 [1 4 6]
 [7 5 8]]
Current move: r

[[1 2 3]
 [7 4 6]
 [5 0 8]]
Current move: r

[[1 0 3]
 [4 2 6]
 [7 5 8]]
Current move: u

[[1 2 3]
 [4 5 6]
 [7 0 8]]
Current move: d

[[1 2 3]
 [4 6 0]
 [7 5 8]]
Current move: r
```

```
[[2 4 3]
 [1 0 6]
 [7 5 8]]
Current move: d

[[2 3 0]
 [1 4 6]
 [7 5 8]]
Current move: r

[[1 2 3]
 [7 0 6]
 [5 4 8]]
Current move: u

[[1 2 3]
 [7 4 6]
 [5 8 0]]
Current move: r

[[0 1 3]
 [4 2 6]
 [7 5 8]]
Current move: l

[[1 3 0]
 [4 2 6]
 [7 5 8]]
Current move: r

[[1 2 3]
 [4 5 6]
 [0 7 8]]
Current move: l

[[1 2 3]
 [4 5 6]
 [7 8 0]]
Current move: r

Goal state achieved!
Total unique states explored: 17
```