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from heapq import heappop, heappush

def print_board(state):
    for row in state:
        print(' '.join(str(x) for x in row))
    print()

def is_goal(state):
    return state == [[1, 2, 3], [4, 5, 6], [7, 8, 0]]

def get_neighbors(state):
    neighbors = []
    x, y = [(i, row.index(0)) for i, row in enumerate(state) if 0 in row][0]
    moves = [(x + dx, y + dy) for dx, dy in [(-1, 0), (1, 0), (0, -1), (0, 1)]]

    for nx, ny in moves:
        if 0 <= nx < 3 and 0 <= ny < 3:
            new_state = [row[:] for row in state]
            new_state[x][y], new_state[nx][ny] = new_state[nx][ny], new_state[x][y]
            neighbors.append(new_state)

    return neighbors

def heuristic(state):
    mismatches = 0
    goal = [[1, 2, 3], [4, 5, 6], [7, 8, 0]]
    for i in range(3):
        for j in range(3):
            if state[i][j] != goal[i][j] and state[i][j] != 0:
                mismatches += 1
    return mismatches

def a_star(start):
    open_set = []
    heappush(open_set, (0, start, []))
    visited = set()
    visited_count = 0

    while open_set:
        cost, state, path = heappop(open_set)
        if is_goal(state):
            return path, visited_count

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        if str(state) not in visited:
            visited.add(str(state))
            visited_count += 1
        for neighbor in get_neighbors(state):
            if str(neighbor) not in visited:
                total_cost = cost + 1 + heuristic(neighbor)
                heappush(open_set, (total_cost, neighbor, path + [neighbor]))

    return None, visited_count

def solve_puzzle(start):
    return a_star(start)

if __name__ == "__main__":
    start_state = [[1, 2, 3], [5, 0, 6], [4, 7, 8]]
    solution, visited_count = solve_puzzle(start_state)

    if solution:
        print("Solution path:")
        for step in solution:
            print_board(step)
    else:
        print("No solution found.")

    print(f"Total visited states: {visited_count}")

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Solution path:

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1 2 3
0 5 6
4 7 8

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1 2 3
4 5 6
0 7 8

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1 2 3
4 5 6
7 0 8

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1 2 3
4 5 6
7 8 0

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Total visited states: 9