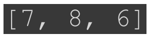
Lab 4

Q) 8 Puzzle problem using iterative deepening

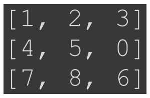
```
from collections import deque

class PuzzleState:
    def __init__(self, board, zero_pos, moves=0, previous=None):
        self.board = board
        self.zero_pos = zero_pos  # Position of the zero tile
        self.moves = moves          # Number of moves taken to reach this state
        self.previous = previous    # For tracking the path

    def is_goal(self, goal_state):
        return self.board == goal_state

    def get_possible_moves(self):
        moves = []
        x, y = self.zero_pos
        directions = [(-1, 0), (1, 0), (0, -1), (0, 1)]  # Up, Down, Left, Right
        for dx, dy in directions:
            new_x, new_y = x + dx, y + dy
            if 0 <= new_x < 3 and 0 <= new_y < 3:
                new_board = [row[:] for row in self.board]
                # Swap the zero tile with the adjacent tile
                new_board[x][y], new_board[new_x][new_y] = new_board[new_x][new_y], new_board[x][y]
                moves.append((new_board, (new_x, new_y)))
        return moves

def ids(initial_state, goal_state, max_depth):
    for depth in range(max_depth):
        visited = set()
        result = dls(initial_state, goal_state, depth, visited)
        if result:
            return result
    return None

def dls(state, goal_state, depth, visited):
    if state.is_goal(goal_state):
        return state
    if depth == 0:
        return None

    visited.add(tuple(map(tuple, state.board)))  # Mark this state as visited
    for new_board, new_zero_pos in state.get_possible_moves():
        new_state = PuzzleState(new_board, new_zero_pos, state.moves + 1, state)
        if tuple(map(tuple, new_board)) not in visited:
            result = dls(new_state, goal_state, depth - 1, visited)
            if result:
                return result
    visited.remove(tuple(map(tuple, state.board)))  # Unmark this state
    return None

def print_solution(solution):
    path = []
    while solution:
        path.append(solution.board)
        solution = solution.previous
    for board in reversed(path):
        for row in board:
            print(row)
        print()

# Define the initial state and goal state
initial_state = PuzzleState(
    board=[[1, 2, 3],
           [4, 0, 5],
           [7, 8, 6]],
    zero_pos=(1, 1)
)

goal_state = [
    [1, 2, 3],
    [4, 5, 6],
    [7, 8, 0]
]

# Perform Iterative Deepening Search
max_depth = 20  # You can adjust this value
solution = ids(initial_state, goal_state, max_depth)

if solution:
    print("Solution found:")
    print_solution(solution)
else:
    print("No solution found.")
```

output :

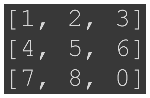
```
Solution found:
[1, 2, 3]
[4, 0, 5]
```



```
[7, 8, 6]
```

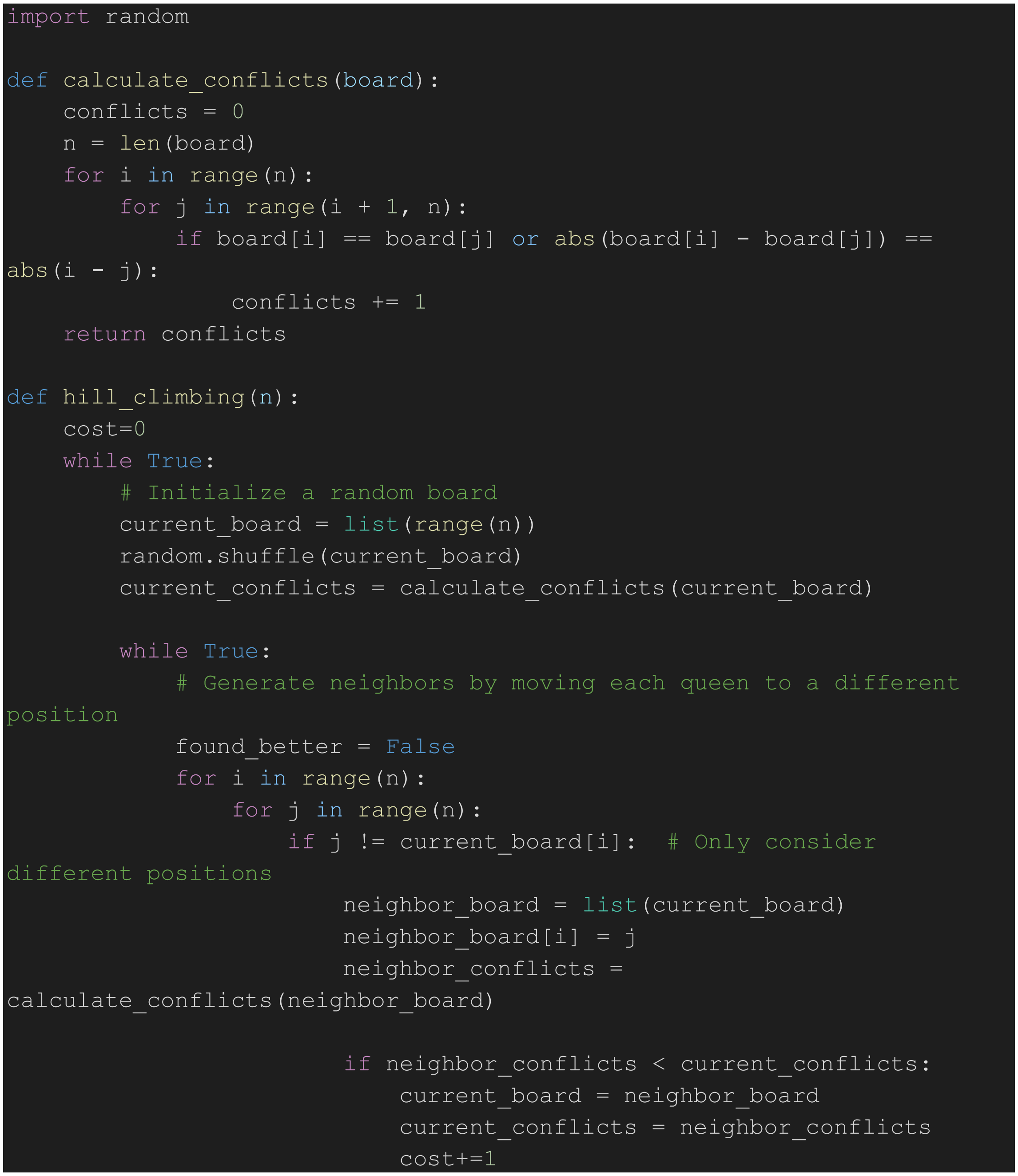


```
[1, 2, 3]
[4, 5, 0]
[7, 8, 6]
```

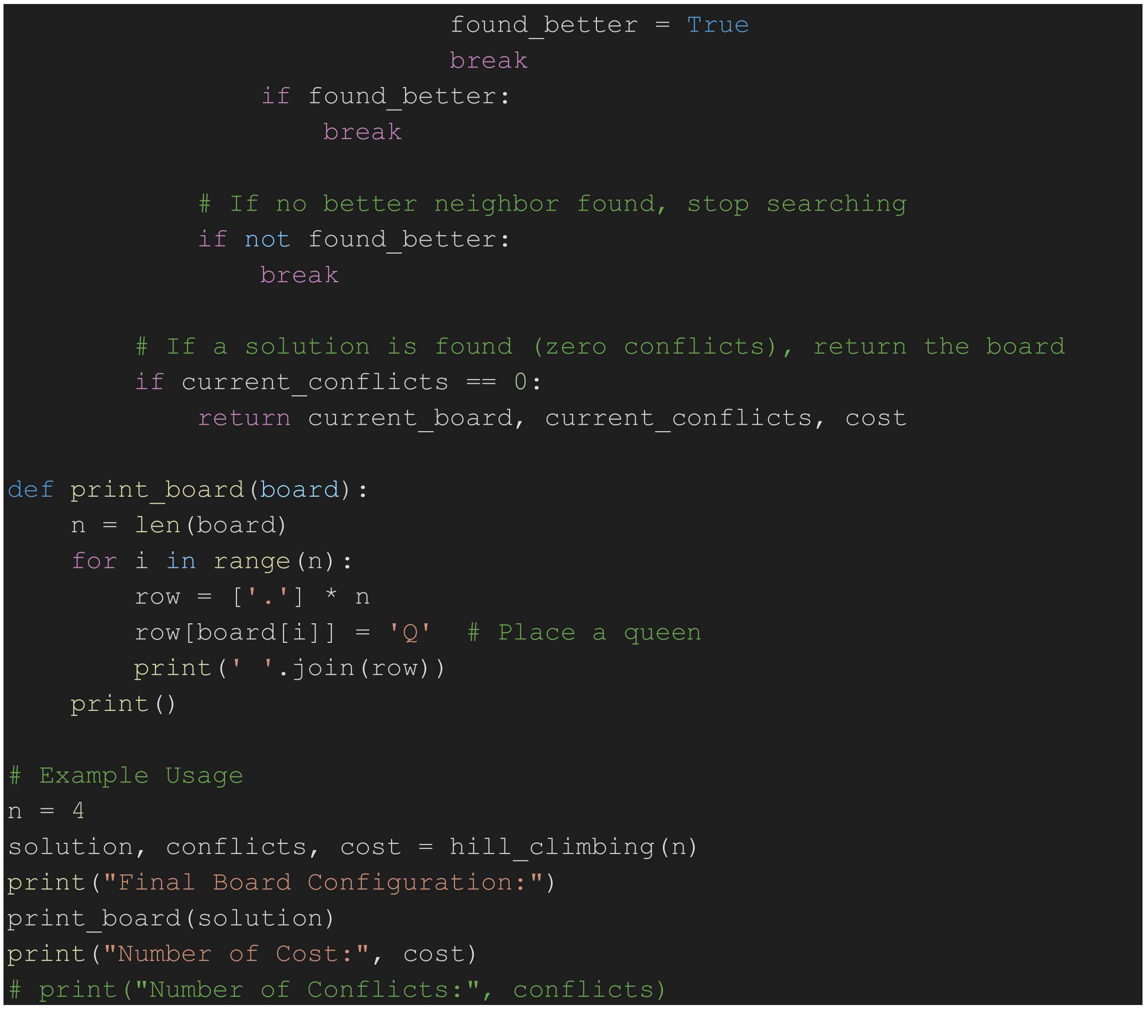


```
[1, 2, 3]
[4, 5, 6]
[7, 8, 0]
```

Q) Hill climb for n queens

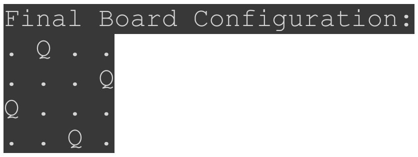


```
import random

def calculate_conflicts(board):
    conflicts = 0
    n = len(board)
    for i in range(n):
        for j in range(i + 1, n):
            if board[i] == board[j] or abs(board[i] - board[j]) ==
abs(i - j):
                conflicts += 1
    return conflicts

def hill_climbing(n):
    cost=0
    while True:
        # Initialize a random board
        current_board = list(range(n))
        random.shuffle(current_board)
        current_conflicts = calculate_conflicts(current_board)

        while True:
            # Generate neighbors by moving each queen to a different
position
            found_better = False
            for i in range(n):
                for j in range(n):
                    if j != current_board[i]:  # Only consider
different positions
                        neighbor_board = list(current_board)
                        neighbor_board[i] = j
                        neighbor_conflicts =
calculate_conflicts(neighbor_board)

                        if neighbor_conflicts < current_conflicts:
                            current_board = neighbor_board
                            current_conflicts = neighbor_conflicts
                            cost+=1
```

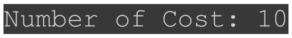


```python
                            found_better = True
                            break
                if found_better:
                    break

            # If no better neighbor found, stop searching
            if not found_better:
                break

        # If a solution is found (zero conflicts), return the board
        if current_conflicts == 0:
            return current_board, current_conflicts, cost

def print_board(board):
    n = len(board)
    for i in range(n):
        row = ['.'] * n
        row[board[i]] = 'Q'  # Place a queen
        print(' '.join(row))
    print()

# Example Usage
n = 4
solution, conflicts, cost = hill_climbing(n)
print("Final Board Configuration:")
print_board(solution)
print("Number of Cost:", cost)
# print("Number of Conflicts:", conflicts)
```

Output :



```
Final Board Configuration:
. Q . .
. . . Q
Q . . .
. . Q .
```



```
Number of Cost: 10
```