LAB-6: Simulated Annealing Algorithm

for:

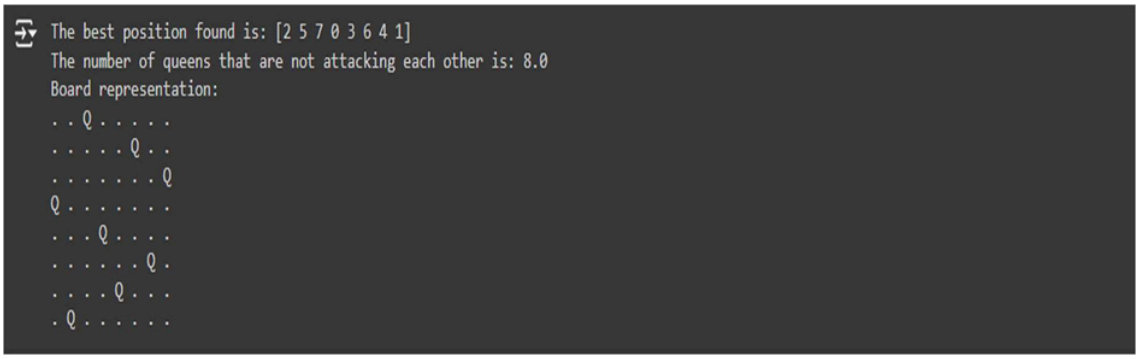
1) 8 queens problem

CODE:

```
import mlrose_hiive as mlrose import numpy as np


def queens_max(posiϴon):
    no_aΣack_on_j = 0
    queen_not_aΣacking = 0
    for i in range(len(posiϴon) - 1):
        no_aΣack_on_j = 0
        for j in range(i + 1, len(posiϴon)):
            if (posiϴon[j] != posiϴon[i]) and (posiϴon[j] != posiϴon[i] + (j - i)) and (posiϴon[j] != posiϴon[i] -
(j - i)):
                no_aΣack_on_j += 1
        if (no_aΣack_on_j == len(posiϴon) - 1 - i):
            queen_not_aΣacking += 1
    if (queen_not_aΣacking == 7):
        queen_not_aΣacking += 1
    return queen_not_aΣacking


def print_board(posiϴon):
    size = len(posiϴon)
    board = np.full((size, size), '.')
    for row, col in enumerate(posiϴon):
        board[row, col] = 'Q'
    print('\n'.join([' '.join(row) for row in board]))


objecϴve = mlrose.CustomFitness(queens_max)
```

```
problem = mlrose.DiscreteOpt(length=8, fitness_fn=objecΘve, maximize=True, max_val=8)
T = mlrose.ExpDecay()

iniΘal_posiΘon = np.array([4, 6, 1, 5, 2, 0, 3, 7])

best_posiΘon, best_objecΘve, fitness_curve = mlrose.simulated_annealing(problem=problem,
schedule=T, max_aΣempts=500, init_state=iniΘal_posiΘon)

print('The best posiΘon found is:', best_posiΘon)
print('The number of queens that are not aΣacking each other is:', best_objecΘve)

print("Board representaΘon:")
print_board(best_posiΘon)
```

OUTPUT:



2) Travelling Salesman Problem

Code:

```
import mlrose_hiive as mlrose
import numpy as np
from scipy.spaΘal.distance import euclidean

# Define the coordinates of the ciΘes
coords = [(0, 0), (1, 5), (2, 3), (5, 1), (6, 4), (7, 2)]
```

```
# Calculate the distances between each pair of ciΘes
distances = []
for i in range(len(coords)):
    for j in range(i + 1, len(coords)):
        dist = euclidean(coords[i], coords[j])
        distances.append((i, j, dist))
fitness_dists = mlrose.TravellingSales(distances=distances)
problem = mlrose.TSPOpt(length=len(coords), fitness_fn=fitness_dists, maximize=False)
schedule = mlrose.ExpDecay(init_temp=10, exp_const=0.005, min_temp=1)
result = mlrose.simulated_annealing(problem, schedule=schedule, max_aΣempts=100,
max_iters=1000, random_state=2)
print("Result structure:", result)
if isinstance(result, tuple) and len(result) == 2:
    best_state, best_fitness = result
else:
    best_state, best_fitness = result[0], result[1]
print("Best route found:", best_state)
print("Total distance of best route:", best_fitness)
```

OUTPUT: