ASSIGNMENT 2

SOLVING TSP USING LOCAL SEARCH

The Travelling Salesman Problem (TSP): Given a list of cities and the distances between each pair of cities, what is the shortest possible route that visits each city exactly once and returns to the origin city? It is an NP-hard problem in combinatorial optimization, important in operations research and theoretical computer science. Often instead of providing the distances between the pairs directly, the Euclidean co-ordinates of the cities are given.

0-1 Exchange

Randomly pick a city and remove it from the route. Then insert it again in a different random position.

1-1 Exchange

Randomly pick two cities from the route and exchange their position.

2 – Opt

A 2-opt move removes two edges from the route and create reconstruct the route such that it does not cross over itself. Try to loop over all pair of edges, until one 2-opt move gives you a better solution. This is called a First Improvement Strategy.

Or-Opt

It attempts to improve the current tour by first moving a chain of three consecutive vertices in a different location (and possibly reversing it) to find an improved route. All possible chain is checked. If no improvement can be obtained, the process is then repeated with chains of two consecutive vertices, and then with single vertices.

THE TASKS

1) Implement First Choice Hill Climbing with the heuristic specified for your subgroup as per the following table. At the time of generating neighbor, select one of the two heuristics uniformly, i.e, with 50% chance Heuristic 1 will be used to generate a neighbor and the rest of the time Heuristic 2 will be used.

Subgroup	Heuristic 1	Heuristic 2
A1	0-1 Exchange	2 Opt (with First Improvement Strategy)
A2	-	-
B1	1-1 Exchange	Or Opt (with First Improvement Strategy)
B2	-	-

2) Run your algorithm with different values of the parameter σ. Each time you will run the algorithm 10 times, compute some statistics and present them as shown in the table. You must prepare the result before submission and show it in hard/soft copy at the time of evaluation.

Problem Instance	σ	Average Number of Iteration	Average Cost	Minimum Cost	Gap
att48	val1				
att48	val2				
att48	val3				
burma14	val4				
burma14	val5				
burma14	val6				

burma14	..				

The symbols bear the meaning as discussed in lecture.

Input Format

The first seven lines contain some information about the problem. You need to read the 4^{th} line to get the number of cities *n*. Starting from 8^{th} line, the co-ordinates of the cities are given. The input file ends with a line with the string "EOF"

Output Format

Print the cost (length of the route) of your solution in the first line. The second line will print the solution as a sequence of integers. Show the resultant route with GUI for bonus marks.

Reference

1) TSP:
https://en.wikipedia.org/wiki/Travelling_salesman_problem

2) Local Search and Stochastic Hill Climbing:

Staring from chapter 4 upto 4.1.2(Excluding) of Russell and Norvig Book

3) 2-opt:

https://en.wikipedia.org/wiki/2-opt