CS 312: Artificial Intelligence Laboratory

Task 3: Randomized Search and Emergent Systems

TSP Problem Description:
Given a set of cities (coordinates) and distances between them, find the best (shortest) tour (visiting all cities exactly once and returning to the origin city) in a given amount of time, viz. Travelling Salesman Problem.

Compare, analyze and efficiently implement the following algorithms for the TSP Problem:
1. Simulated Annealing:
   Try out a minimum of 2-3 different temperature cooling schedules and compare the results with valid reasoning.
2. Genetic Algorithm:
   Try out different population sizes and compare the results.
3. Ant Colony Optimisation:
   Try out different numbers of ants and compare the results.

Input Format:

You will be given files in the following format:
- First line will contain either *euclidean* or *noneuclidean* indicating whether the distances between the cities are Euclidean or not.
- Second line will contain the number of cities (**N**). E.g. 100 (Indices 0 - 99)
- Next **N** lines will contain the two-dimensional coordinates (space separated) of the cities.
- Next **N** lines will contain **N** space separated distances between cities, in order.
- All coordinates and distances will be floating point numbers.

Three sample files have been attached on moodle.

Output Format:
Your output should be following:
- First line will contain the tour length found
- Second line will contain tours as space separated indices of cities, per line. Do not write the origin city's index at last again. Rotated tours will be considered the same. Invalid tours will be considered as no tours at all.

Make sure to print your best tours and tour lengths to stdout as soon as you find them because only the last valid tour will be considered for evaluation.

Submission format:
You need to submit the following:
- Code

- Script to run your code called run.sh which accepts an input file name as argument.
- Report

Submit a zip with your groupID as the name: eg. 1.zip

Evaluation Criteria:
Correctness : 15
Report: 15
Code Quality: 5
Viva: 5

Deadline: 11:59 PM 3 Feb 2020

Late Submission Policy: 5% of marks will be deducted per day late.
For Reference :

Genetic Algorithms: https://www.youtube.com/watch?v=THSNf9mPsmA
Simulated Annealing: https://www.youtube.com/watch?v=dg5zUxdAE_E
Ant Colony Optimisation: https://www.youtube.com/watch?v=V-Yipf9GuH0

Report Format :
1. Simulated Annealing Analysis and Observation:
   a. Perturbation method chosen to generate a neighbour (and why)
   b. Cooling schedules tried
   c. Results
   d. Effect of cooling schedule on tour found
2. Genetic Algorithm Analysis and Observation:
   a. Representation chosen and why (Path/Adjacency/Ordinal)
   b. Crossover Operator chosen (give reason)
   c. Results
   d. Effect of population size on tour found
3. Ant Colony Optimisation Analysis and Observation:
   a. Results
   b. Effect of number of ants on tour found
4. Conclusion -- compare all results, comment on the advantage and disadvantage of each algorithm, which algorithm will you prefer for TSP