Computational Intelligence for the IoT 2021/2022

Lab 13 (Project 2) – Heuristic Optimization (Week 7)

1 – Objective

The Oeiras Municipality is implementing a new intelligent system for recollection of recyclable materials. 100 intelligent EcoPoints, where the citizens deposit recyclable materials, have been distributed along the Municipality. Each EcoPoint has sensors to detect and predict when they will get full, and each day, at 23:59, they communicate wirelessly to the Central indicating if they must be emptied.

Each day at midnight, a program must be run to assign a route to the garbage truck that will collect the recyclables in the full EcoPoints. It is estimated that, on average, the truck will have to pass by 20 Ecopoints. It will rarely have to pass by more than 50 locations, although, the whole system must be prepared to cope with the day where all 100 EcoPoints get simultaneously full. The Municipality only has 20 minutes to decide the best route the truck should follow (otherwise the workers might not be able to finish the route during their work hours (and extra hours will have to be paid).

You will develop an intelligent system that, given a list of up to 100 EcoPoints, returns the shortest route that starts from the Central (C), runs through all the Ecopoints locations in the list (E_i) and returns to the Central.

2 – Data

You will use the file "Project2_DistancesMatrix.xls", that contains distances between the 100 EcoPoints.

3 – Implementation, Evaluation and Validation

You will have to implement two different approaches to solve this problem: Genetic Algorithms and Ant Colony Optimization. Use the knowledge you have learnt about the two approaches in order to make the appropriate choices regarding the implementation details.

The system will receive the list of the EcoPoints to visit (variable size, up to 100), and will return a route (list of EcoPoints) that starts and ends at C, and the respective route length. (Note: the list size includes the starting location, C). The list should be a .csv file (C doesn't need to be in the list, only de ecopoint number).

3.1 – Show example results for each technique and for differently sized inputs (including run time).

3.2 – What is the length of the shortest route that runs through all 100 Ecopoints? Indicate the best result for each technique.

3.3 – Which approach would you choose to implement considering the Municipality restrictions? Explain and justify your choice (assume the Municipality will use the same computer you are using).

4 – Submission Details and Deadline

This Lab will be evaluated as the 2nd project, and accounts for 35% of the Lab final grade. It must be completed and submitted via Fenix until Monday, June 27th, at 23:59.

You will have to write a report where you indicate all the options you made regarding the implementation of each technique, and answer questions 3.1, 3.2, and 3.3. Include the code in your report.

(Optional: include the files corresponding to lab 12 for obtaining bonus points)