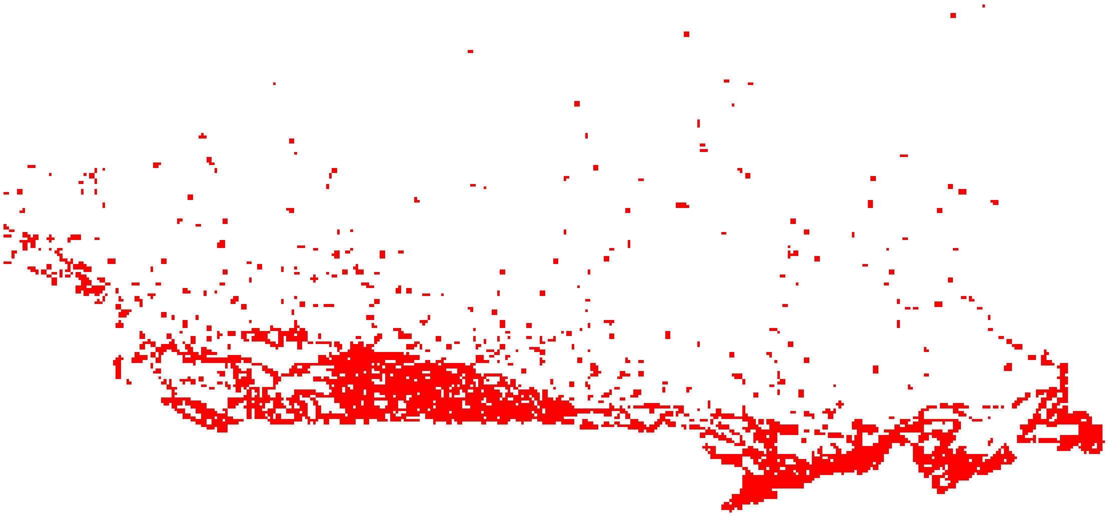
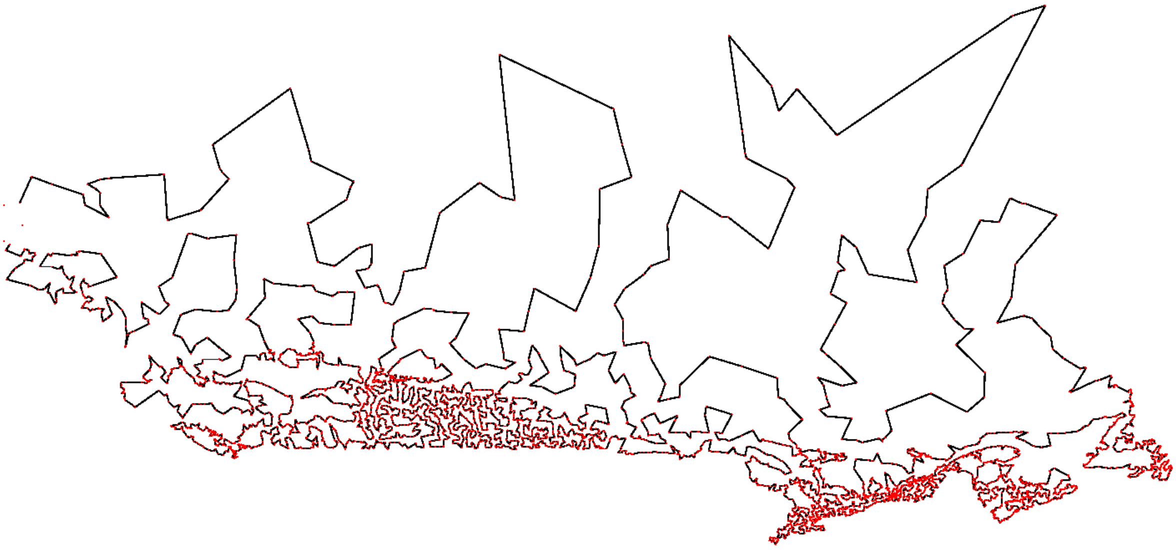
CMP3004 Formal Languages and Automata Theory Project
Due Date: June 19, 2021

Traveling Salesman Problem (TSP) is an NP-complete problem and currently we do not have a fast algorithm for its solution, known algorithms are exponential. In this project you are going to implement heuristic algorithms for the solution of TSP. Heuristic algorithms do not guarantee to return the optimal solution; however, they return good enough solutions in a reasonable time.

The specific TSP problem you will attempt to solve contains 4,663 Cities in Canada. The XY coordinates of the cities are given in the attachment. The figure below shows these cities in the XY-plane.



The shortest tour length is 1,290,319 and it is shown visually below.



You are required to implement (either using **C++** or **Java**) three heuristics given below:

1. Nearest Neighbor Algorithm
2. Greedy Algorithm
3. Divide and Conquer Strategy

All of the above heuristics are described in https://github.com/norvig/pytudes/blob/master/ipynb/TSP.ipynb.

As explained in the grading section we will sort all the projects according to the difference of their best result to the shortest tour and 20% of the points will be given according to this sorted list. In order to improve your position in the sorted list, you can try different techniques (other than the three heuristics given above). You can find extra resources on the Internet or you might think of improvement strategies by yourself.

What to submit?

a) A video recording in which you present your project and each team member explains his/her contribution (video should be at most 10 minutes in total). **The format of the video should mp4.**

b) A report (in **PDF format**) which contains the following information:
   - The results of the TSP heuristic algorithms. In the results you should report the tour, its length, the time, and a visualization of the tour for each heuristic.
   - If you use methods other than the three heuristics given above, you should also describe them in your report.

c) Code of the project.

d) Submit your files through itslearning system. Late submissions will get lower grade by 10% for each day.

e) Make a **single submission for each group** and provide the group member names at the top of the report.

Grading:

a) 70%: Correctness (whether you correctly implemented all the three heuristic algorithms). Clarity of code will be also important.

b) 20%: Distance to shortest tour. We will sort all projects according to their best result to the shortest tour and distribute these points (20%) according to this sorted list. The closest one will get all the points and the last one will get no points. Clearly present your best result both in the report and in the video presentation.

c) 10%: Project report.

Important Notes:

a) The project is at most **3 PERSON** size. We encourage everybody to work in groups.

b) You should implement the project using either **C++** or **Java** language. For visualizations you can use **Python**.
c) You can use libraries, but you must implement the heuristics by yourself.

Cheating Policy:

You should not copy and paste source code from Internet, another person, or a book. All the source codes will be filtered through a similarity analysis tool, which is known to be effective against many types of code copying and changing tricks. These projects will be graded as 0.