

Activity 4

Optimization with Genetic Algorithms

- **Git Repository**

<https://github.com/YoussefEzz/Genetic-Algorithm>

- **Description of the chromosome**

We have **G** cities(nodes) indexed in TSPLIB as **0,1,2,...,G-1** , each two cities are connected with some distance(edge weights) represented as a matrix **G * G**.

One of the goals in TSP(Travel salesman problem) is to traverse all cities under the condition of starting and ending up in the same city.

Assume we have 5 cities (0 to 4) and the salesman starts at city 0 and takes the path: 0 -> 1 -> 2 -> 3 -> 4 -> 0 then the search space is all permutations of the cities that start and end with the same start city and the chromosome is a subset of that search space

So for G cities and start city 0 the chromosome sample is and it's length is **G+1**:

0	1	2	...	G - 1	0
---	---	---	-----	-------	---

- **Fitness Function**

Another goal is to find the minimum path that traverses all cities.so, to evaluate how close the chromosome is to this goal the fitness function is to calculate the sum of distances between every two successive cities in the chromosome

0	1	2	...	G - 1	0
---	---	---	-----	-------	---



$$\text{Fitness} = \text{Weight}[0][1] + \text{Weight}[1][2] + \dots + \text{Weight}[G-1][0]$$

The smaller the sum the more fit is the chromosome

-