

TP5: Optimization

Part1: Online-optimizer

Use the following link: <https://online-optimizer.appspot.com/?model=builtin:default.mod>

- Solve the following LP problem and report the solution.

$$\text{Min} \quad 3x_1 + 2x_2$$

subject to

$$x_1 + x_2 \leq 9$$

$$3x_1 + x_2 \leq 18$$

$$x_1 \leq 7$$

$$x_2 \leq 6$$

$$x_1, x_2 \geq 0$$

Part2: Travelling Salesman Problem

A clear example is the [Travelling Salesman Problem](#): Suppose there are several locations in a city that need to be visited, having the distances of every pair of points stored in a matrix. The objective is to complete the cycle following the optimal path, the one which minimizes the traversed distance.

How is the algorithm?

The Held-Karp algorithm is developed to solve this problem. This algorithm is a brute search algorithm that belongs to the family of the [Branch and bound](#) family. The algorithm will evaluate all the possible alternatives, keeping the best one and using it as a threshold to improve. The uploaded file contains an example of an input file and 2 variants of the Held-Karp algorithm:

1. Example.txt

It is an example of a distance, where the different rows and columns refer to different locations. The main diagonal is always zero because the distance from one location to itself is always zero.

Note: The distance A-B could be different from the distance B-A.

2. HK_Paths.java

The first implementation of the algorithm allows us to see all the possibilities with their distances.

1- Is this implementation efficient? Why?

3. HK_Optimal.java

The second implementation of the algorithm is HK_Optimal.java

1- What is the difference between HK_Paths.java and HK_Optimal.java

2- What is the optimal solution for the example? How do you evaluate the Held-Karp algorithm solution? Is it optimal? Why?

3- Does it matter from where we start?

4- Improve the algorithm and explain for which reason your algorithm is better? (time, complexity, solution quality and etc.)