Travelling salesman problem

We will consider an undirected graph $G = (V, E)$ with a cost function $c : E \to \mathbb{R}$.

We need to find an hamiltonian cycle with the smallest cost.

$$\begin{cases} \min \sum_{e \in E} c_e x_e \\ \sum_{e \in \delta(v)} x_e = 2 \qquad \forall v \in V \\ \sum_{e \in E(S)} x_e \leq |S| - 1 \qquad \forall S \subseteq V, \ |S| \geq 3 \\ x_e \in \{0, 1\} \qquad \forall e \in E \end{cases}$$

Add in the thesis an historical paragraph and the model we want to solve

Usually $n = |V| \sim$ thousands. We will consider only $n \leq 500$ to use branch and cut, but for $n \geq 1000$ we must use heuristics.

If we want to sell an algorithm we need to create various heuristics and parameters, and we need to compare the different versions.

We define a test-bed : set of 100 instances with $n \sim 300$ and another 100 instances with $n \sim 1000$

We test the methods with this test bed.

We can use only $100 \rightarrow 10$ instances due to computational issues.

We consider a complete graph (note that since G is undirected, we can consider only a Half matrix)

A city is (x_i, y_i) and $c_{ij} = d((x_i, y_i), (x_j, y_j))$

$$= \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2}$$

We must use double values to store the costs c_{ij} with a flag that tells me if I need to round the value

$x = [x_0, \dots, x_i, \dots, x_n]$

$y = [y_0, \dots, y_i, \dots, y_n]$

$\Big\}$ point $= [(x_i, y_i)]$

$\Downarrow$

point[i].x = x_i

point[i].y = y_i

We can use TSPLIB as a library for TSP instances

We need to parse the informations from the library

We may also generate n random points in the space

$D_x, D_y = [0, 10000]$