

Symmetric Travelling Salesman Problem
Linear Programming
lab work

Using cplex

store the following problem into trial.lp

```
maximize 2x1 + x2
subject to
4x1 + 5x2 <= 14
x1 - x2 <= 4
bounds
0 <= x1
0 <= x2
end
```

run cplex, installed as

« [c:/Program Files/IBM/ILLOG/CPLEX_Studio124/cplex/bin/x64_win64/cplex.exe](#) »

load the problem : `read trial.lp`

solve it : `opt`

notice the objective function's value .

display the variables values : `display solution var -`

Solving the TSP

The distance matrix is stored in france.txt for the intercity distances of 24 towns in France, numbered 1 to 24. The C code in « `initial.c` » can be used to store the distances matrix into memory.

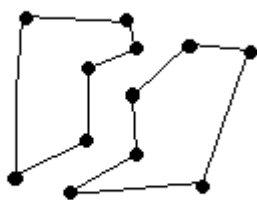
The initial problem is stated as follows :

variable $x_{ij}, i < j : 0 \leq x_{ij} \leq 1, x_{ij} = 1$ means edge $i - j$ is selected

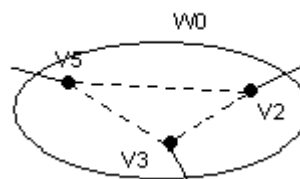
$$\forall \text{town } i : \sum_{j \neq i} x_{\min(i,j) \max(i,j)} = 2$$

$$\min \sum_{vars} d_{ij} x_{ij}$$

Two kinds of additional constraints are available and illustrated below (see joigned



Exemple de sous tournées



document inequalities.jpg).

The solving methodology is as follows :

1. generate, with a C code the initial problem in MPS format (see above example), according to distances values stored in france.txt
2. read and solve the LP using cplex
3. draw the solution onto a France map (joined map file `france.gif`)
4. if not a valid solution reached, identify and add comb and subtour constraints
5. goto 2

Work to do

1. understand the subtour and comb constraints
2. write C code (or Java) for generating the initial LP program, starting with « `initial.c` », a subtour constraint and a comb constraint programs
3. solve for France and Europe.