Multiple Traveling Salesman Problem (mTSP)

Model

```
using CP;

int cities = ...;
int salesmen = ...;
int K = ...;
int L = ...;
range city = 0..cities;
range sale = 1..salesmen;
float coord[i in city][j in 1..2] = ...;

tuple triplet { int p1; int p2; int d; };
{triplet} dist = {< p1, p2,ftoi(round(sqrt(((coord[p1][1])-(coord[p2][1]))^2+(coord[p1][2]-coord[p2][2])^2)))>
          | p1, p2 in city } ;

dvar interval task[t in city][l in sale] optional(t>1);
dvar sequence lane[l in sale] in all (t in city) task[t][l];

dexpr int num[l in sale] = sum(t in city: t>1)(presenceOf(task[t][l]));
dexpr float y = sum(l in sale) endOf(task[1][l]);

minimize y;
subject to {
        c1:
                forall (t in city: t>1)
                        sum(l in sale) presenceOf(task [t][l])==1;
        c2:
                forall (l in sale) {
                        noOverlap(lane[l], dist);
                        first(lane[l],task[0][l]);
                        last (lane[l],task[1][l]);
                }
        c3:
                forall (l in sale) {
                        num[l]>=K;
                        num[l]<=L;
                }
}
```

Results

1) small_eil51

Input:

cities = 10;
salesmen = 3;
K = 3;
L = 8;
coord = [[37, 52],[49, 49],[52, 64], [20, 26],[40, 30],[21, 47],[17, 63],[31, 62],
[52, 33],[51, 21]];

Output:

S1: 0 5 10 3 1
S2: 0 6 7 2 1
S3: 0 4 9 8 1

Time: 2.25s

2) eil51

Input:

cities = 50;
salesmen = 2;
K = 23;
L = 27;
coord = [[37, 52],[49, 49],[52, 64],[20, 26],[40, 30],[21, 47],[17, 63],[31, 62],
[52, 33],[51, 21],[42, 41],[31, 32],[5, 25],[12, 42],[36, 16],[52, 41],[27, 23],
[17, 33],[13, 13],[57, 58],[62, 42],[42, 57],[16, 57],[8, 52],[7, 38],[27, 68],
[30, 48],[43, 67],[58, 48],[58, 27],[37, 69],[38, 46],[46, 10],[61, 33],[62, 63],
[63, 69],[32, 22],[45, 35],[59, 15],[5, 6],[10, 17],[21, 10],[5, 64],[30, 15],
[39, 10],[32, 39],[25, 32],[25, 55],[48, 28],[56, 37],[30, 40]];

Setting:

solutions limit: 16

Output:

S1: 0 21 25 6 22 42 23 13 24 17 3 16 36 11 45 50 26 5 47 7 30 27 2 35 34 19 1
S2: 0 31 10 37 48 9 38 32 44 14 43 41 18 39 40 12 46 4 8 29 33 49 15 20 28 1

Time: 1.66s