Technische Universität Berlin
Institut für Mathematik

Wintersemester 11/12

Computational Integer Programming

PD Dr. Ralf Borndörfer
Dr. Thorsten Koch

Exercise sheet 13

Deadline: Thu, 10 Feb. 2012, by email to `klug@zib.de`

Exercise 1. **4 points**

What has to be change in the transformation of m-ATSP to ATSP if

a) every salesman must visit at least one city or
b) $k \leq m$ must visit at least one city.

The slides with the transformation you could find on the lecture's web page. There are include in the zip-archiv for exercise 13.

Exercise 2. **16 points**

Implement the transformation from a *Vehicle Routing Problem (VRP)* to a TSP and test it with the VRP instance of the lecture. The resulting TSP instance should be solver with the CONCORDE TSP solver. You will find the data instance and all required information on the web page. CONCORDE can be downloaded from `http://www.tsp.gatech.edu/concorde` for almost all platforms. You are free to use every programming or scripting language for implementation.

The subtasks are:

a) Parsing the VRP data file and construct a m-ATSP instance.
   Take the problem definition of the VRP without tour length restriction from the exercise slides. Think about how you model the vehicle capacity of one.
b) Transform the m-ATSP instance into a 1-ATSP instance with the construction presented in the exercise.
c) Transform the ATSP into a TSP.
d) Write the TSP instance file in TSPLIB format.
   (Documentation: `http://comopt.ifi.uni-heidelberg.de/software/TSPLIB95/`)
e) Solve the TSP instance with CONCORDE. It is also an online solver of CONCORDE available (`http://neos.mcs.anl.gov/neos/solvers/co:concorde/TSP.html`). CONCORDE solves the problem and write a solution file with the optimal node sequence. The first number of this sequence is the number of visited nodes.
f) Translate the solution back to the original VRP. This does not have to be implemented, the solution is sufficient.

Hint: Start with a small instance of 2 or 3 trips and check the result after each step.
Questions: `klug@zib.de`.