Computational Integer Programming

PD Dr. Ralf Borndörfer
Dr. Thorsten Koch

Exercise sheet 1
Deadline: Thu, 27 Oct 2011, **16:15 in MA 313**

Exercise 1. ε **points**

Install the ZIBoptimizationSuite 2.0.1 on your desktop/laptop. This package contains the three package SCIP, SOPLEX, and ZIMPL which are needed through the course.

You can just download the package (`http://zibopt.zib.de`) and install directly (which is recommended for `Linux` and `Mac` user) or you can use the virtual machine which we provided on the web page together with a `README` (which is strongly recommended for `Windows` user).

Exercise 2. **-5 to 0 points**

This exercise is obligatory!

Create a file `MembersXY.txt` where XY stands for your group number containing the data of your group members. For each member type a line in the following format (without changing the order of entries, additional spaces, etc.):

```
matriculation number, ␣ surname, ␣ first name, ␣ semester, ␣
study course, ␣ sex, ␣ email
```
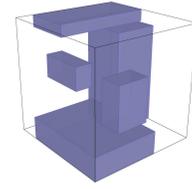
The following is an example for a complete file:

```
123456, M\"uller, Lieschen, 3, TWM, f, liesel@gmx.net
654321, Klein, H\"anschen, 4, ITM, m, hansi@dot.com
987654, Strau\"s, Andr\'e, 5, Mathe Diplom, m, andre@strauss.de
```

One of the group members send this file **and** the ZIMPL **models of the two following exercises** to `heinz@zib.de` not later than Thursday, 27 Oct 2011, 16:15.

Exercise 3.   **10 points**

A number of bricks of different sizes have to be packed into a large box, in such a way that the sum of all side lengths of the box is minimized. Each brick has to be positioned with its edges parallel to the edges of the whole box and naturally different bricks may not overlap.

(a) Model the problem as an integer program using ZIMPL.

(b) Try to solve the problem (using ZIMPL and SOPLEX) for five cubes of side lengths $1, \ldots, 5$.

Exercise 4.   **10 points**

Model the production flow of a farm in South America for one year using ZIMPL. The farmer has 7 plants for cultivation, namely wheat, clover, beans, onions, cotton, corn, and tomatoes. Decide on how many hectare each plant should be cultivated. The following data are known:

(a) The required allotment of land in each month related to the total cultivation of a plant species (see table `allocation.data`), which can be less than 1, since plants needs in some months only one part of the land (e.g. at harvests).

(b) The expenditure of human labor (in working days per month) for sowerings, care, and crop for each plant (see table `expenditure.data`).

(c) The crop (in tons per hectare), the selling price (in dollar per ton), the operating costs (in dollar per hectare) (for water, fertilizer, etc.) are:

	Wheat	Clover	Beans	Onions	Cotton	Corn	Tomatoes
Crop	1,5	6,5	1	3	1,5	2	3
Price	100	0	200	125	350	70	120
Cost	10	0	5	50	80	5	50

(d) The farm has a size of 4 hectare.

(e) The manpower of the farmer is 25 working days per month. (The month has 25 working days.)

(f) An additional worker that can be hired by the month costs $4 per day. There is only one additional worker that can be hired.

(g) The farmer can also sell (by the month) manpower for $3 per day.