

# Optimierung I

## Excercise Sheet 1

Submission: until 14:00 on Tuesday, Mai 2 2017

### Exercise 1.1

10 Points

Convert the following (LP) to standard form:

$$\begin{array}{rcllcl} \min & 3x_1 & - & 3x_2 & + & 7x_3 & & \\ & x_1 & + & x_2 & + & 3x_3 & \leq & 40 \\ & x_1 & + & 9x_2 & - & 7x_3 & \geq & 50 \\ & 5x_1 & + & 3x_2 & & & = & 20 \\ & & & |5x_2 & + & 8x_3| & \leq & 100 \\ & x_1 & , & x_2 & , & & \geq & 0 \end{array}$$

Hint: Take use of slack variables.

$$\begin{array}{l} ax \leq b \\ x \geq 0 \end{array} \Rightarrow \begin{array}{l} ax + z = b \\ x, z \geq 0 \end{array}$$

### Exercise 1.2

10 Points

The management of a hospital has need of the following carer personnel:

Time	Required Personnel
0:00 bis 4:00	50
4:00 bis 8:00	60
8:00 bis 12:00	40
12:00 bis 16:00	50
16:00 bis 20:00	30
20:00 bis 24:00	25

A shift is eight hours long and starts at 0:00, 4:00, 8:00, 12:00, 16:00 or 20:00. Find a duty roster with the smallest personnel expenditure. Formulate the problem as an optimization problem! Is the feasible set convex?

### Exercise 1.3

10 Points

In order to transport  $n$  balls with radius  $r$ , it should be constructed a rectangular box with the minimal surface area. Formulate the problem as optimization problem. Is the feasible set convex?

**Exercise groups:**

Please submit your exercise sheet in groups of two.

Homepage of the Lecture: [http://www.zib.de/ss17\\_Optimierung\\_I](http://www.zib.de/ss17_Optimierung_I)

Questions?: [klug@zib.de](mailto:klug@zib.de)