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> January 16, 2015 Deadline: January 15, 2015, 11:30 am

# Optimization

# WS 2014/15

#### Exercises 3

## 1. (PORTA – Polyhedron Representation Transformation Algorithm)

Install the PORTA package and read the manpages (http://typo.zib.de/opt-long\_projects/Software/Porta/).

Given the following ILP:

max	$x_1$	+	$x_2$	+	$x_3$	+	$x_4$
w.r.t.							
	$x_1$	+	$x_2$	+	$x_3$	$\leq$	2
	$x_1$	+	$x_2$	+	$x_4$	$\leq$	2
			$x_3$	+	$x_4$	$\leq$	1

 $x_1, x_2, x_3, x_4$  integral

- (a) Solve the LP relaxation with a solver.
- (b) Generate all feasible integral points using program *vint* (PORTA package).
- (c) Transform the point representation into the halfspace representation using program *traf* (PORTA package).
- (d) Solve the resulting linear program again with your lp solver.

## 2. Critical Mixed Cycles

Prove the following lemma (see lecture script):

A subset  $T \subseteq E$  is a trace, if and only if G' = (V, T, H) does not contain a critical mixed cycle.

#### 3. n-Queens-Problem

Write down an ILP for the so called *n*-queens-problem:

Place as much queens as possible on a  $n \times n$  chess board such that no two queens interfere. Thus:

- In each vertical line ...
- In each horizontal line ...
- In each diagonal line ...

... is only one queen allowed