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Deadline: January 19, 2017, 11:45 am

Optimization

WS 2016/17

Exercise 3

1. (POLYMAKE)

Install the POLYMAKE package (or use the online version) and read the documentation (<https://polymake.org/doku.php>). (You will also find POLYMAKE under /import.)

Given the following ILP:

$$\begin{array}{ll} \max & x_1 + x_2 + x_3 + x_4 \\ \text{w.r.t.} & \\ & x_1 + x_2 + x_3 \leq 2 \\ & x_1 + x_2 + x_4 \leq 2 \\ & x_3 + x_4 \leq 1 \\ & x \geq 0 \end{array}$$

$$x_1, x_2, x_3, x_4 \text{ integral}$$

- Solve the LP relaxation with a solver using MATLAB.
- Generate all feasible integral points using the command LATTICE_POINTS.
- Transform the point representation into the halfspace representation using the command FACETS.
- Solve the resulting linear program again with your lp solver.
- What do you notice? Explain your observations.

(Hand in screen shots or a .txt file showing your commands)

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