Prof. Dr. Rüdiger Ehlers Francisco Palau, M.Sc.

Applied Computational Engines 2018 – Assignment Sheet 7

Due: **Monday, 4th June 2018, 7:30am**

Please indicate your **name** and **email address**. You can work in **groups** of up to **three** students. Only one submission per group is necessary. However, in the tutorials every group member must be able to present the solutions to each problem solved by your group.

Please submit your solutions either

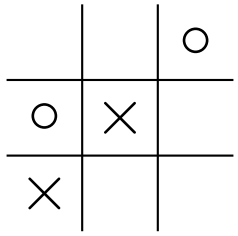
- by e-mail to `fpalau@uni-bremen.de` **and** `rehlers@uni-bremen.de`, or
- on paper in **letter box 52** (Francisco Palau-Romero) on floor 6 of the MZH building.

Note that you will need 50% of the points on all exercise sheets in order to take the "Fachgespräch" OR the oral exam. We may ask you to present your solutions in the tutorial, especially if you work in a group. We aim for asking everyone taking part in the course to present at least twice during the course of the semester.

Practical QBF Solving (30 pts.)

Model the following problem as a QBF instance and use `depqbf` to solve it.

Assume that while playing Tic-Tac-Toe, we have the following setting:



Does the × player (who started the game) have a strategy to win within **her next next** move? So we want to know if she can enforce to win within the next two moves of her, with a single move of the ○ player in between.

For simplicity, you may assume that the ○ player has no chance to win, and hence the question which player gets three of their symbols in a line, row, or diagonal **first** is not of relevance. We only care about whether the × player has a strategy to get three × symbols in a row, column, or diagonal.

Linear programming (20 pts.)

Model the following problem as a linear programming (LP) problem.

A factory produces an *alloy*, consisting of several raw metals. The target alloy has the following specification:

- Iron: 87-92%
- Vanadium: 2-3%
- Titanium: 1-3%
- Copper: 2-4%
- Chrome: 1-4%

The factory can buy the following materials to mix the alloy from:

Material	**% Iron**	**% Vanadium**	**% Titanium**	**% Copper**	**% Chrome**	**Cost/kg**
Raw iron	100	0	0	0	0	$ 15
Recycling A	92	3	2	0	3	$ 7
Recycling B	85	3	4	7	0	$ 20
Recycling C	95	1	2	2	0	$ 10
Recycling D	85	0	1	4	10	$ 15

Model the scenario as an input file to the solver `lp_solve` and find out which is the cheapest way to produce the desired target alloy.