T-79.5102 **Autumn 2007**
Special Course in Computational Logic
Tutorial 4

1. Consider the following program involving choice, cardinality, and weight rules in addition to normal rules:

$\{\mathsf{Coffee}, \mathsf{Tea}, \mathsf{Cookie}, \mathsf{Cake}, \mathsf{Cognac}\}.$
$\{\mathsf{Cream}, \mathsf{Sugar}\} \leftarrow \mathsf{Coffee}.$
$\mathsf{Cognac} \leftarrow \mathsf{Coffee}.$
$\{\mathsf{Milk}, \mathsf{Lemon}, \mathsf{Sugar}\} \leftarrow \mathsf{Tea}.$
$\mathsf{Mess} \leftarrow \mathsf{Milk}, \mathsf{Lemon}.$
$\mathsf{Happy} \leftarrow 1\,\{\mathsf{Cookie}, \mathsf{Cake}, \mathsf{Cognac}\}.$
$\mathsf{Broke} \leftarrow 6\,[\mathsf{Coffee} = 1, \mathsf{Tea} = 1, \mathsf{Cookie} = 1, \mathsf{Cake} = 2, \mathsf{Cognac} = 4].$
$\mathsf{OK} \leftarrow \mathsf{Happy}, {\sim}\mathsf{Broke}, {\sim}\mathsf{Mess}.$
$\leftarrow {\sim}\mathsf{OK}.$

(a) Verify that $M = \{\mathsf{OK}, \mathsf{Happy}, \mathsf{Lemon}, \mathsf{Tea}, \mathsf{Biscuit}\}$ is a stable model of the program by
– reducing the program with respect to M and
– computing the least model for the reduct.

(b) Find out another model for the program and verify it.

(c) Find out the exact number of stable models using `smodels`.

2. Translate a cardinality rule

$$a \leftarrow (n + m - 1)\,\{b_1, \dots, b_n, {\sim}c_1, \dots, {\sim}c_m\}.$$

where $n + m \geq 1$ back to normal rules.

3. Consider the problem of designing a round-robin tournament of n teams where each team plays the other team exactly once.

This implies that $\frac{n\times(n-1)}{2}$ matches are organized in total and the tournament lasts $n - 1$ weeks when scheduled for $\frac{n}{2}$ fields.

(a) Write a cardinality constraint program (in the input language of `lparse`) to schedule tournaments of this kind.

(b) What is the number of solutions when $n = 4$? Is there a good explanation for this number? Can you estimate/calculate the number solutions when $n = 10$?

(c) What is the effect of assuming that matches organized each week take place simultaneously?

(d) Study how $|\mathrm{Gnd}(P)|$ and $|\mathrm{Hb}(\mathrm{Gnd}(P))|$ change as n grows.