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

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

(a) Verify that $M = \{\text{OK, Happy, Lemon, Tea, Biscuit}\}$ 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 \texttt{smodels}.

2. Translate a cardinality rule

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

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 \texttt{p4ense}) 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 of solutions when $n = 10$?
(c) What is the effect of assuming that matches organized each week take place simultaneously?
(d) Study how $|\text{Gnd}(P)|$ and $|\text{Hb}(\text{Gnd}(P))|$ change as $n$ grows.