Assignment #4

Constraintsystem $B$

Download boole.pl from [http://www.uni-ulm.de/in/pm/mitarbeiter/betz.html](http://www.uni-ulm.de/in/pm/mitarbeiter/betz.html). It contains implementations for the constraints `neg/2`, `and/3`, `or/3`, `xor/3`, and `imp/2` of the Boolean Algebra. Use this constraint-solver for the following exercises.

Exercise 1 (Equivalence).

Extend boole.pl with rules (similar to the ones already defined) in order to cope with equivalence, i.e. implement simplifications for a CHR-constraint equiv($X$, $Y$, $Z$) which obey the given truth table.

<table>
<thead>
<tr>
<th>$X$</th>
<th>$Y$</th>
<th>$Z$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Exercise 2 (Who lies?).

Lehmann says Mueller lies.
Mueller says Schulze does not tell the truth.
Schulze says both lie.

Write a Prolog-predicate `tellTruth(Lehmann,Mueller,Schulze)` which succeeds iff the three arguments are a valid interpretation of the given statements by Lehmann, Mueller, and Schulze. Use Boolean junctors constraints `and`, `neg`, ....

**Hint:** Lehman’s statement can be modelled by `Lehmann=MuellerLies`, or using equivalence, with `MuellerLies` being the negation of `Mueller`.

Exercise 3 (Cross Circuit).

A cross circuit exchanges two wires/signals with the help of a logic circuit without crossing them physically. For the input pins ($X$, $Y$) and the output pins ($A$, $B$) we have $A = Y$ and $B = X$.

Write a CHR constraint `cross($X$, $Y$, $A$, $B$)`, which implements a cross circuit by means of Boolean constraints.

Test with queries `cross(1,0,A,B)`, `cross(1,Y,1,B)` and `cross(0,Y,A,B)`.