

assignment #5 (winter term 2005)  
solutions will be presented Tuesday, 29-Nov-2005, 2 PM, o27/2203  
<http://www.informatik.uni-ulm.de/pm/index.php?id=112>

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**Exercise 1** (CLP Cryptoarithmic Puzzle).

Replace distinct letters by distinct digits (numbers have no leading zeros), s.t. the following calculation holds (a literal translation to English is “Test thoroughly your strengths.”).

$$\begin{array}{rcccccc} & & T & E & S & T & E \\ + & & F & E & S & T & E \\ + & & D & E & I & N & E \\ \hline = & K & R & A & F & T & E \end{array}$$

- a) Stick to the example presented in the course and use the library `clpfd`.
- b) Write a predicate `distinct(L)` which is true if all elements from list `L` have a value from  $\{0, 1, \dots, 9\}$  and are (pairwise) distinct. Use the library `clpq`.

**CCLP**

We use (a subset of) the Constraint Handling Rules (CHRs) to program in the CCLP paradigm. The following CCLP-clause

$$H \leftarrow C : D \mid G$$

is written by

$$N @ H \iff C \& D \mid G$$

where `N @` is an optional name for the rule.

- (1) Read the SICStus manual on how to use CHRs. Before using CHR rules, the CHR library and a handler must be set by `:- use_module(library(chr)). handler h.`
- (2) In order to differentiate (built-in) predicates from constraints, the latter have to be declared, e.g. `constraints con/1.`
- (3) The rule `N @ H \iff C \mid G` is a short form of `N @ H \iff C \& true \mid G.`

**Exercise 2** (Comparison of CLP and CCLP).

Compare the following CLP- (in the left column) and CCLP-programs (in the right column), which consist of *one* of the given rules by posing the queries given below. Check your answers with the system’s answers. Make sure, you understand why seemingly innocuous rules produce different answers.

<code>p(a) :- true.</code>	<code>p1 @ p(a) \iff true \mid true.</code>
<code>p(X) :- X=a.</code>	<code>p2 @ p(X) \iff X=a \mid true.</code>
<code>p(X) :- X = a, X = b.</code>	<code>p3 @ p(X) \iff true \mid X=a.</code>
	<code>p4 @ p(X) \iff true \&amp; X = a \mid true.</code>
	<code>p5 @ p(X) \iff X = a \&amp; X = b \mid true.</code>

Queries: (a) `p(a)`, (b) `p(b)`, and (c) `p(C)`.

**Exercise 3.** Implement the three (different) variants of the CCLP-example `min` (minimum) from the lecture in CHR. Test and explain the different responses of the variants by posing the following six queries (only one at a time).

`min(1,2,C).`    `min(A,2,1).`    `min(A,2,3).`  
`min(A,A,B).`    `min(1,2,1).`    `min(1,2,3).`