Constraint Programming

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assignment #3 (winter term 2005)
solutions will be presented Tuesday, 15-Nov-2005, 2 PM, o27/2203
http://www.informatik.uni-ulm.de/pm/index.php?id=112

Exercise 1 (Herbrand Interpretation)**.**
Consider the following sets of formulae.

$$M_1 = \{p(a,b), q(b,c), \forall X \forall Y \forall Z p(X,Z) \land q(Z,Y) \rightarrow p(X,Y)\}$$
$$M_2 = \{\text{nat}(0), \forall X \text{ nat}(X) \rightarrow \text{nat}(s(X)), q(b) \rightarrow p(a)\}$$

Give the Herbrand-base H_i and two different Herbrand-models M_{i_1}, M_{i_2} for each set ($i = 1, 2$).

Exercise 2 (Declarative Sum)**.**

a) Modify the definition of the predicate `sum(X,Y,Z)` (from #2), s.t. computations are done for all directions by splitting the sum `Z` into its summands `X` and `Y`: Generate two integers from the interval [1..10], compute their sum, and check if this equals the value of `Z`, otherwise backtrack.
Trace the query `?- sum(X,Y,10)`.

b) Enhance the definition in order to speed up the search by pruning unreachable parts of the search tree.
Hint: For example, consider the goal `sum(X,Y,10)`. For a chosen value for `X`, the value for `Y` can be computed.
Give several examples in order to explain how backtracking improved.

Exercise 3 (Map Coloring)**.**

The Prolog predicate `color(Map,Colors)` should succeed if each state could be assigned a color from `Colors`, s.t. no two bordering states have the same color. The element of the list `Map` are tuples (`Land,Color`).
You can find a list with the border topology on the course web page.
Compute a valid assignment using four colors.