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Abstract Machines

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8. Homework   *Deadline: 23 June 2004 12:00*

Exercise 1:   *8 Points*

All positive numbers can be declared as successors of 0, like:
$0 \equiv 0$
$1 \equiv succ(0)$
$2 \equiv succ(succ(0))$
$3 \equiv succ(succ(succ(0)))$
...

Write a prolog program including the following predicates:

  a) $less/2$ where the first parameter is smaller than the second parameter. (e.g. $less(succ(0), succ(succ(succ(0))))$)

  b) $add/3$ where the third parameter is the sum of the first two parameters. (e.g. $add(succ(0), succ(succ(0)), succ(succ(succ(0))))$)

  c) $mul/3$ where the third parameter is the multiplication of the first two parameters.

  d) $fact/2$ where second parameter is the factorial of the first parameter.

Exercise 2:   *6 Points*

We represent trees using the terms $leaf$ and $node(s, t, u)$ where s is some value, and t and u are trees. Write a prolog program including the following predicates:

  a) $size/2$ where the second parameter is the size of the first parameter which is a tree. (e.g. $size(node(a, leaf, node(b, leaf, leaf)), succ(succ(0)))$)

  b) $member/2$ where the first parameter occurs at some node in the second parameter which is a tree. (e.g. $member(a, node(a, leaf, leaf))$)

  c) $insert/3$ where third parameter is obtained by inserting the first parameter into the second parameter which is a tree. (e.g. $insert(a, node(b, empty, empty), node(b, node(a, empty, empty), empty))$)

Exercise 3:   *6 Points*

Unify t and s

$$
\begin{aligned}
t &\equiv p(X_1, \ldots, X_n) \\
s &\equiv p(f(X_0, X_0), f(X_1, X_1), \ldots, f(X_{n-1}, X_{n-1}))
\end{aligned}
$$

Compare the costs for the unification with and without occur check!