Exercise 2

Foundations of Logic Programming

Prof. Michael Thielscher, Sebastian Voigt

International Master Program in Computational Logic — winter term 2008/2009

Date of Exercise: 10.11.2008

Exercise 2.1

Find two terms s and t such that s is an instance of t but where s and t cannot be unified. Explain your answer.

Exercise 2.2

Prove the associativity of substitutions for a term s, i.e., prove that

$$(s\theta)\delta = s(\theta\delta)$$

(Hint: You may want to use structural induction on the structure of s)

Exercise 2.3

Use the Martelli-Montanari algorithm step by step to unify the following pairs of terms with variables x, y, and z. For each step indicate which rule you have used and the reduction wrt. $\prec_3$ of the termination proof for the MM-algorithm.

a) $f(g(x), g(c), y)$ and $f(g(g(y)), x, a)$

b) $f(b, x, x, y)$ and $f(b, g(y), g(g(z)), g(a))$

c) $f(x, g(z), g(z))$ and $f(h(y), y, g(h(x)))$

Give the corresponding most general unifier (mgu) or give the reason why the terms are not unifiable.

Exercise 2.4

In the proof of the termination of the MM algorithm, a lexicographic ordering on triples of the form $(uns(E), lfun(E), card(E))$ is used. Show examples why orderings on triples of the form $(lfun(E), uns(E), card(E))$ or of the form $(uns(E), card(E), lfun(E))$ would not work.

Exercise 2.5

Consider the following description: “A dog is happy if the sun is shining or if it plays with a toy. It can play with a toy only if somebody is present and is willing to launch it. Frank and Max are present and Max is willing to launch a stick.”

a) Formalize the given description by specifying a prolog program. Additionally, give the logic formulae that correspond to the program.

b) Show a query and an SLD-derivation which proves that the dog is happy. What are the resultants of the derivation?

c) Give the computed answer substitution (CAS) of the derivation from b).