
HW 4 – Unification

CS 421 – Summer 2013

Revision 1.0

Assigned June 20, 2013

Due June 28, 2013, 11:59 PM

Extension 48 hours (20% penalty)

1 Change Log

1.0 Initial Release.

2 Turn-In Procedure

Your answers to the following questions are to be submitted electronically via the `handin` script.

3 Objectives and Background

The purpose of this HW is to test your understanding of

- how to perform unification

Another purpose of HWs is to provide you with experience answering non-programming written questions of the kind you may experience on the midterms and final.

4 Problem

(15 pts) Solve the following unification problem, or prove that it cannot be solved, using the algorithm presented in class. Show all your work: at each step, note which equation (pair) was selected, which rule was applied, what substitutions (if any) were remembered, and what pairs remain to be solved. Assume that f, g, h are constructors/function symbols and that x, y, z are variables. Once you're finished, verify your solution (if one exists) by applying the resulting substitution to each pair and checking that the left and right sides are made equal.

$$\{(f(f(y), h(x)), f(x, z)), (g(x), g(f(y)))\}$$

Answer:

- Decompose $(f(f(y), h(x)), f(x, z))$, leaving:

$$\{(f(y), x), (h(x), z), (g(x), g(f(y)))\}$$

- Orient $(f(y), x)$, leaving:

$$\{(x, f(y)), (h(x), z), (g(x), g(f(y)))\}$$

- Orient $(h(x), z)$, leaving:

$$\{(x, f(y)), (z, h(x)), (g(x), g(f(y)))\}$$

- Eliminate $(z, h(x))$, remembering the substitution $\{z \mapsto h(x)\}$ and leaving:

$$\{(x, f(y)), (g(x), g(f(y)))\}$$

- Eliminate $(x, f(y))$, remembering the substitution $\{x \mapsto f(y)\}$ and leaving:

$$\{(g(f(y)), g(f(y)))\}$$

- Delete $(g(f(y)), g(f(y)))$, leaving the empty set. Now apply the second substitution to the first and combine them, to reach a final solution of $\{z \mapsto h(f(y)), x \mapsto f(y)\}$. We can see that this transforms the original two pairs into $(f(f(y), h(f(y))), f(f(y), h(f(y))))$ and $(g(f(y)), g(f(y)))$.