Tutorials for “Automated Reasoning WS20/21”
Exercise sheet 6

Exercise 6.1:
Compute an mgu for the following unification problems using both $\Rightarrow_{SU}$ and $\Rightarrow_{PU}$ where $x$, $y$, $z$ and their primed versions are all variables and there is only one sort:

1. $\{ f(x, h(x, y)) = f(f(y, z), h(y, z')) \}$
2. $\{ h(x, y) = z, g(f(x, x)) = z', g(g(f(a, y))) = g(z') \}$
3. $\{ h(x, y) = h(x', y'), y' = f(x, a), f(g(a), z) = y \}$

Exercise 6.2:
Compute a most general unifier of $P(h(x_1), x_4, g(x_2, f(x_2)))$ and $P(h(x_4), g(f(x_3), x_5), x_1)$.

Exercise 6.3:
Prove the following statements or provide a counter example:

1. If $|s| > |t|$ then there is no substitution $\sigma$ with $s\sigma = t$.
2. If $|\text{vars}(s)| > |\text{vars}(t)|$ then there is no substitution $\sigma$ with $t\sigma = s$. where $\text{vars}$ computes the set of variables from a term.

Exercise 6.4:
Check satisfiability of the following first-order clauses using NRCL.

\[
\begin{align*}
(1) \quad & \neg R(x, x) \\
(2) \quad & R(a, b) \\
(3) \quad & \neg R(x, y) \lor R(y, x) \\
(4) \quad & \neg R(x, y) \lor \neg R(y, z) \lor R(x, z)
\end{align*}
\]

Is it not encouraged to prepare joint solutions, because we do not support joint exams.