Exercise 8.1: (4 P)
Prove Theorem 3.25.2-3.

Exercise 8.2: (3 P)
Determine whether the following formula is satisfiable or not:
\[
\forall x (p(x) \rightarrow p(f(x))) \land p(b) \land \neg p(f(f(b)))
\]
by first transforming the formula to CNF, then applying to the obtained clause set Resolution for General Clauses.

Exercise 8.3: (4 P)
Using the standard and the polynomial unification rules, compute most general unifiers of \(P(g(x_1, g(f(x_3), x_3)), g(h(x_4), x_3))\) and \(P(g(x_2, x_2), g(x_3, h(x_1)))\), if any exists.
(Make sure that you understand differences between the two unification schemas.)

Exercise 8.4: (2 P)
Using the polynomial unification rules, compute a most general unifier of the two atoms from Exercise 7.5.
(Compare your solution with the one of Exercise 7.5, make sure that you understand differences between the two unification schemas.)
**Challenge Problem:** (2 Bonus Points)
We call a term $t$ linear if any variable occurs at most once in $t$. We define the depth of a term $t$ to be $\max\{|p| \mid p \in \text{pos}(t)\}$. Now consider two linear terms $s, t$ that do not share variables. Prove that for any mgu $\sigma$ of $s$ and $t$ we have

$$\max(\text{depth}(t), \text{depth}(s)) = \max(\text{depth}(t\sigma), \text{depth}(s\sigma))$$

Submit your solution in lecture hall 002 during the lecture on June 15. Please write your name and the date of your tutorial group (Tue, Wed, Fri) on your solution.

**Note:** Joint solutions are not permitted (work in groups is encouraged).