AI 1 2022/23
Assignment10: Knowledge Representation
– Given Jan. 21, Due Jan. 29 –

Problem 10.1 (Unification) 30 pt

Decide whether (and how or why not) the following pairs of terms are unifiable.
$S_1 \in \Sigma_2^p, S_2 \in \Sigma_3^p, f \in \Sigma_1^f, g \in \Sigma_2^f, c \in \Sigma_0^f$

1. $S_1(g(f(x), g(x, y)), y)$ and $S_1(g(z, v), f(w))$
2. $S_2(g(f(x), g(x, u)), f(y), z)$ and $S_2(g(g(g(u, v), f(w)), f(c)), f(g(u, v)), f(c))$

Problem 10.2 (First-Order Resolution) 35 pt

Prove the following formula using resolution.
$P \in \Sigma_1^p, R \in \Sigma_2^p, a, b \in \Sigma_0^f$

$$\exists X.\forall Y.\exists Z.\exists W.((\neg P(Z) \wedge \neg R(b, a)) \vee \neg R(a, b) \vee R(W, a) \vee (P(Y) \wedge R(X, b)))$$

Problem 10.3 (First-Order Tableaux) 35 pt

Prove the following formula using the first-order free variable tableaux calculus.
We have $P \in \Sigma_1^p$.

$$\exists X.(P(X) \Rightarrow \forall Y.P(Y))$$