

CPSC 625 – Homework 3

due: Mon, April 9, 2007

1. Do problem 8.6 in the textbook (translating sentences into first-order logic).
2. Determine whether or not the following pairs of predicates are unifiable. If they are, give the most-general unifier and show the result of applying the substitution to each predicate. If they are not unifiable, indicate why. Variables are in capital letters; constants are lowercase.

- a) $P(a, X, f(g(Y)))$ and $P(Z, f(Z), f(U))$
- b) $Q(f(a), g(X))$ and $Q(Y, Y)$
- c) $R(f(Y), Y, X)$ and $R(X, f(a), f(V))$
- d) $P(a, Y, f(X))$ and $P(X, f(b), f(b))$
- e) $Q(g(f(a)), g(X), Z)$ and $Q(Y, Y, f(X))$
- f) $P(a, X, g(f(f(a))), X)$ and $P(Z, f(Z), g(Y), f(Z))$
- g) $Q(f(a, a), Y, Z)$ and $Q(X, f(Z, Z), Y)$

3. Using first-order rules of inference, prove that “there exists a vegetarian” from the following pieces of knowledge: anyone who does not eat meat is a vegetarian, tomatoes are not meat, carrots are not meat, and there is someone who eats only tomatoes and carrots. The initial sentences (premises) are translated into first-order logic for you below. The goal is to generate: $\exists X \text{vegetarian}(X)$. Be sure to explicitly label each new sentence with the one(s) it was derived from, along with the inference rule and any substitution used. (Hint: try existential elimination, implication elimination, and resolution.)

1. $\forall P (\forall X \text{eat}(P, X) \rightarrow \neg \text{meat}(X)) \rightarrow \text{vegetarian}(P)$
2. $\forall X \text{tomato}(X) \rightarrow \neg \text{meat}(X)$
3. $\forall X \text{carrot}(X) \rightarrow \neg \text{meat}(X)$
4. $\exists P \forall X \text{eat}(P, X) \rightarrow (\text{tomato}(X) \vee \text{carrot}(X))$