CS575 – Questions for Qualification Exam

Fall 2002 - Closed Book

Question 1. Use the unification algorithm to find out whether each following set of simple expressions is unifiable or not. If it is, compute a most general unifier for the set.

- $S = \{p(f(a), g(x)), p(y, y)\}$.
- $S = \{p(a, x, h(g(z))), p(z, h(y), h(y))\}$.

Name well-known proof procedures that use the unification algorithm.

Question 2. Sam, Clyde, and Oscar are elephants. We know the following facts about them:

1. Sam is pink.
2. Clyde is gray and likes Oscar.
3. Oscar is either pink or gray (but not both) and likes Sam.

Use resolution refutation to prove that a gray elephant likes a pink elephant, i.e., prove $\exists x, y.[Gray(x) \wedge Pink(y) \wedge Likes(x, y)]$.

Hint: Represent the information by a first-order theory with the predicates $Gray$, $Pink$, and $Likes$; Convert to CNF; Use resolution.

Question 3. Given the program P, whose language contains two constants a and b. P consists of the following rules:

$$
\begin{array}{lcl}
p(X) & \leftarrow & \mathit{not}\ q(X). \\
q(X) & \leftarrow & \mathit{not}\ p(X). \\
p(a) & \leftarrow & \\
q(b) & \leftarrow &
\end{array}
$$

- Compute a stable model of P.
- Does $P \models p(a)$ hold? Why?
- Does $P \models p(b)$ hold? Why?

where $\models$ denotes the entailment relation with respect to the stable model semantics of logic programs.

Question 4. Represent the information in Question 2 by a logic program with constraint rules. Use additional predicates if necessary. Make sure that your program would also entail the conclusion that a pink elephant likes a gray elephant. Give arguments for the correctness of your program.