1994 Paper 6 Question 9

Foundations of Logic Programming

Describe in detail an algorithm for finding the most general unifier of two terms. Illustrate your answer by unifying the following pairs of terms:

$$f(x, a, x) \quad \text{with} \quad f(a, y, b)$$
$$f(x, y, z) \quad \text{with} \quad f(g(y), z, a)$$
$$f(g(y), y, z) \quad \text{with} \quad f(x, z, x)$$

The variables above are x, y and z. [8 marks]

"The resolution method relies on *most general* unifiers because they are unique." Discuss. [3 marks]

The resolution method can be applied directly to any first-order formula, regardless of its structure. Discuss and evaluate the following proposals for dealing with special cases:

(a) If the formula has the form $\neg A$, then apply the resolution method to A. Failure to prove A establishes that $\neg A$ is a theorem.

(b) If the formula has the form of a disjunction $A \vee B$, then apply the resolution method separately to A and to B. If either proof succeeds then $A \vee B$ is a theorem.

(c) If the formula has the form of a conjunction $A \wedge B$, then apply the resolution method separately to A and to B. If both proofs succeed then $A \wedge B$ is a theorem.

(d) If the formula has the form $A \rightarrow B$, convert A to clauses. Then apply the resolution method to B, allowing A's clauses to take part in applications of the resolution rule. If this proof succeeds then $A \rightarrow B$ is a theorem.

[9 marks]