

## 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:

$$\begin{aligned} f(x, a, x) & \text{ with } f(a, y, b) \\ f(x, y, z) & \text{ with } f(g(y), z, a) \\ f(g(y), y, z) & \text{ with } f(x, z, x) \end{aligned}$$

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]