

1999 Paper 6 Question 10

Logic and Proof

Describe the role of Herbrand models in mechanical theorem proving. What may we infer when a set of clauses has no Herbrand model? [3 marks]

The remainder of this question concerns using clause methods to determine whether or not the formula

$$\exists x [P(x) \wedge Q(x)] \rightarrow \exists x [P(f(x, x)) \vee \forall y Q(y)]$$

is a theorem.

Convert the problem into clause form. Justify each step you take and explain in what respect the set of clauses is equivalent to the original problem. [4 marks]

Describe the Herbrand universe for your clauses. [3 marks]

Produce a resolution proof from your clauses, or give reasons why none exists. [4 marks]

Exhibit a Herbrand model for your clauses, or give reasons why none exists. [6 marks]