## 1999 Paper 5 Question 10

## Logic and Proof

How do Prolog clauses differ from the clauses used by general-purpose resolution theorem provers? [2 marks]

Describe the series of resolutions that is performed by a Prolog interpreter when it is supplied with a program and a set of clauses. To illustrate your answer, explain how the following program executes when presented with the goal  $\leftarrow Q(f(f(f(f(a)))))$ :

$$Q(a) \leftarrow \tag{1}$$

$$Q(f(a)) \leftarrow \tag{2}$$

$$Q(f(f(x))) \leftarrow Q(f(x)), Q(x) \tag{3}$$

[7 marks]

Considering the program and the goal  $\leftarrow Q(f(f(f(a))))$  now as a set of clauses, derive the empty clause using general resolution. (Full credit requires finding the shortest derivation.) [6 marks]

Consider the set of clauses consisting of the program given above and the goal  $\leftarrow Q(\underbrace{f(\cdots f(a))\cdots})$ . Let p(n) be the number of steps executed by a Prolog

interpreter when given those clauses. Let r(n) be the minimum number of steps required to derive the empty clause from those clauses using general resolution. Compare the approximate growth rates of p(n) and r(n) as n increases, and explain any difference you find. [5 marks]