

## 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  $\leftarrow Q(f(f(f(f(a)))))$  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  $\leftarrow Q(\underbrace{f(\dots f(a)\dots)}_n)$ . 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]