

## 1998 Paper 4 Question 8

### Computation Theory

Explain *Church's Thesis*, making clear its connection with computability.  
[3 marks]

Define precisely what is meant by the set of all *Primitive Recursive (PR)* functions.  
[4 marks]

Outline steps that would enable you to recursively enumerate the set of all PR functions, showing how to determine the arity of each function generated (little detail is required).  
[7 marks]

Suppose that  $V(n, x)$  is a recursive enumeration of all the PR functions of arity 1. By considering the function  $v(x) = S(V(x, x))$  or otherwise, show that

(a) the enumerating function  $V(n, x)$  cannot itself be Primitive Recursive;  
[4 marks]

(b) there are Total Recursive functions that are not Primitive Recursive.  
[2 marks]