1998 Paper 11 Question 9

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 $v(x) = S\big(V(x, x)\big)$ 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]