2003 Paper 3 Question 7

Computation Theory

What is meant by a *register machine*? Explain the action of a register machine program. [6 marks]

What does it mean for a partial function $f(x_1, \ldots, x_n)$ of n arguments to be *register machine computable*? [3 marks]

Design register machines to compute the following functions.

$f(x_1, x_2) = x_1 + x_2$ [2 marks]

$g(x_1) = \begin{cases} 42 & \text{if } x_1 > 0 \\ \text{undefined} & \text{otherwise} \end{cases}$ [2 marks]

$h(x_1) = 2^{x_1}$ [4 marks]

Give an example of a function that is not register machine computable, stating clearly any well-known results you use. [3 marks]