COMPUTER SCIENCE TRIPOS Part IB – 2018 – Paper 6

6 Computation Theory (AD)

(*a*) What does it mean to say that a partial function $f : \mathbb{N}^k \rightharpoonup \mathbb{N}$ is *register machine computable*? [2 marks]

(*b*) Show that the following functions are register machine computable:

(*i*) $\text{add}(x, y) \triangleq x + y$;

(*ii*) $\max(x, y) \triangleq \begin{cases} y & \text{if } x \leq y \\ x & \text{otherwise} \end{cases}$; and

(*iii*) $\text{comp}(x, y) \triangleq \begin{cases} 0 & \text{if } x \leq y \\ 1 & \text{otherwise.} \end{cases}$

[9 marks]

(*c*) What does it mean to say that a function $f : \mathbb{N}^k \to \mathbb{N}$ is λ-*definable*? [2 marks]

(*d*) Is every λ-definable function register-machine computable? Give a detailed justification for your answer. [7 marks]