Computation Theory

(a) Explain how each number \( e \in \mathbb{N} \) can be decoded uniquely as a register machine program \( \text{Prog}_e \). \[6 \text{ marks}\]

(b) What would it mean for a register machine to decide the halting problem? \[4 \text{ marks}\]

(c) Prove that such a register machine cannot exist. (You may assume the existence of suitable register machines for copying registers and manipulating lists of numbers so long as you specify their behaviour clearly.) \[10 \text{ marks}\]