2009 Paper 8 Question 7

Types

(a) Explain what is meant by a *solution* for a Mini-ML typing problem $\Gamma \vdash M : ?$ and what it means for a solution to be *principal*. [4 marks]

(b) Consider the following typing problems (where α and β are distinct type variables).

(i) $x : \forall\{\beta\}(\beta \to \alpha) \vdash x\,(x\,\texttt{nil}) : ?$

(ii) $x : \forall\{\alpha\}(\beta \to \alpha) \vdash x\,(x\,\texttt{nil}) : ?$

(iii) $x : \forall\{\beta\}(\beta \to \alpha\ \mathit{list}) \vdash x :: (x\,\texttt{nil}) : ?$

(iv) $x : \forall\{\alpha\}(\beta \to \alpha\ \mathit{list}) \vdash x :: (x\,\texttt{nil}) : ?$

For each typing problem, either give a solution together with a proof of typing, or show that no solution exists. [16 marks]