(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 $\alpha$ and $\beta$ are distinct type variables).

(i) $x : \forall\{\beta\}(\beta \rightarrow \alpha) \vdash x(x\text{nil}) : \_\_\_\_$

(ii) $x : \forall\{\alpha\}(\beta \rightarrow \alpha) \vdash x(x\text{nil}) : \_\_\_\_$

(iii) $x : \forall\{\beta\}(\beta \rightarrow \alpha \text{ list}) \vdash x :: (x\text{nil}) : \_\_\_\_$

(iv) $x : \forall\{\alpha\}(\beta \rightarrow \alpha \text{ list}) \vdash x :: (x\text{nil}) : \_\_\_\_$

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