

10 Semantics of Programming Languages (PMS)

Explain the issues involved in the design of type systems with subtyping for a language with types

$$T ::= \text{INTEGER} \mid \text{REAL} \mid \text{BOOL} \mid \text{UNIT} \mid T_1 \rightarrow T_2 \mid \{lab_1 : T_1, \dots, lab_k : T_k\} \mid T \text{ REF}$$

You should include precise rules for subsumption and for the definition of the subtype relation $<:$. You should also include examples as appropriate, but there is no need to include the standard operational semantics or expression typing rules.

[20 marks]