

COMPUTER SCIENCE TRIPOS Part IB – 2012 – Paper 6

10 Semantics of Programming Languages (SS)

This question is about a simple functional programming language with the following syntax.

Expressions: $e ::= x \mid \text{skip} \mid \text{fn } x : T \Rightarrow e \mid e e'$

Types: $T ::= \text{unit} \mid T \rightarrow T'$

- (a) Give rules defining a typing relation (\vdash) for this language. [5 marks]
- (b) Give a brief illustration of the following concepts: *free variables* and *closed expression*. [2 marks]
- (c) Give rules defining a transition relation (\longrightarrow) for this language. Use the call-by-value evaluation order, and take care to say what the values are. [5 marks]
- (d) State and prove a Type Progress theorem for this language. [8 marks]