COMPUTER SCIENCE TRIPOS Part IB – 2023 – Paper 6

10 Semantics of Programming Languages (nk480)

Consider the language with functions, integers, and printing.

The typing rule for print(e) is:

$$\frac{\Gamma \vdash e : \mathsf{int}}{\Gamma \vdash \mathsf{print}(e) : \mathsf{unit}}$$

- (a) Define a small-step, call-by-value operational semantics for this language. Clearly explain what the components of the machine configuration are, and how it identifies what is printed.
 [10 marks]
- (b) State a progress theorem for this language, and explain what it says about the evolution of the machine state. [4 marks]
- (c) Prove progress for the print(e) case, giving the names of any of the standard properties (such as substitution) that you needed to use in the proof.

[6 marks]