

## 2005 Paper 5 Question 11

### Semantics of Programming Languages

- (a) Give a call-by-name small-step operational semantics and typing rules for the syntax below.

$$e ::= \mathbf{fn} \ x \Rightarrow e \mid e_1 \ e_2 \mid x$$

[5 marks]

- (b) State and prove Determinacy.

[6 marks]

- (c) State and prove Type Preservation.

[9 marks]

Any standard lemmas you use must be stated precisely, but need not be proved.