

## 2007 Paper 5 Question 7

### Concepts in Programming Languages

- (a) Give an overview of the FORTRAN execution model (or abstract machine) and comment on its merits and drawbacks from the viewpoints of programming, compilation, execution, etc. [5 marks]
- (b) What is *garbage collection* in the context of programming languages? Comment on its merits/drawbacks and explain the contexts in which it arises, giving examples. [5 marks]
- (c) Recall that Algol has a primitive static type system. In particular, in Algol 60, the type of a procedure parameter does not include the types of its parameters. Thus, for instance, in the Algol 60 code

```
procedure P( procedure F )
begin F(true) end ;
```

the types of the parameters of the procedure parameter *F* are not specified.

Explain why this piece of code is statically type correct. Explain also why a call *P(Q)* may produce a run-time type error, and exemplify your answer by exhibiting a declaration for *Q* with this effect.

Why does this problem not arise in SML? [5 marks]

- (d) Give an implementation of the abstract data type of stacks using the SML module system. [5 marks]