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]