2007 Paper 6 Question 7

Concepts in Programming Languages

(*a*) Give an overview of the LISP abstract machine (or execution model) and comment on its merits and drawbacks from the viewpoints of programming, compilation, execution, etc. [5 marks]

(*b*) Define the following parameter-passing mechanisms: pass-by-value, pass-by-reference, pass-by-value/result, and pass-by-name. Briefly comment on their merits and drawbacks. [5 marks]

(*c*) What is *aliasing* in the context of programming languages? Explain the contexts in which it arises and provide examples of the phenomenon. [5 marks]

(*d*) Consider the Simula declarations

$$\text{CLASS A; A CLASS B;}$$

which have the effect of producing the subtype relation B<:A, and

$$\text{REF(A) a; REF(B) b;}$$

Recall that Simula uses the semantically incorrect principle that

$$\text{if B<:A then REF(B)<:REF(A)}$$

and consider now the following Simula code

```
PROCEDURE ASSIGNa( REF(A) x )
    BEGIN x :- a END ;

ASSIGNa(b);
```

Does it statically type check? If so, will it cause a run-time type error?

Justify your answers. [5 marks]