6 Concepts in Programming Languages (MPF)

(*a*) Write a LISP program for detecting whether a LISP interpreter treats the
language as being dynamically scoped (as was the case in historical LISP) or as
being statically scoped (as is the case in modern LISP). You may use pseudo-code
and should explain your answer in detail. [4 marks]

(*b*) You manage two junior programmers and overhear the following conversation:

> A: "I don't know why anyone needs a language other than Java, it
> provides clean thread-based parallel programming."
> B: "Maybe, but I write my parallel programs in a functional
> programming language because they are then embarrassingly parallel."

Discuss the correctness of these statements and the extent to which they cover
the range of languages for parallel programming. [6 marks]

(*c*) Explain why the SML interpreter accepts the declarations

```
datatype 'a FBtree = node of 'a * 'a FBtree list;

fun dfs P (t: 'a FBtree)
= let  exception Ok of 'a;
       fun auxdfs( node(n,F) ) = if P n then raise Ok n
           else foldl (fn(t,_) => auxdfs t) NONE F;
   in  auxdfs t handle Ok n => SOME n  end;
```

while it does not accept the declaration

```
exception Ok of 'a;
```
[4 marks]

(*d*) Consider the declarations

```
structure Z = struct type t = int; val z = 0 end;

structure A = Z  :   sig type t        ; val z: t end;
structure B = Z  :>  sig type t = int ; val z: t end;
structure C = Z  :>  sig type t        ; val z: t end;
```

in the SML Modules language.

Explain the behaviour of the SML interpreter on inputting each of the
expressions

```
Z.z = A.z;   Z.z = B.z;   Z.z = C.z;
```
[6 marks]