# 2009 Paper 3 Question 2

**Concepts in Programming Languages**

(*a*)  List *three* differences between the programming languages FORTRAN and LISP.

[3 marks]

(*b*)  Give an example of a weakness in the type system of a programming language of your choice, explaining how it leads to a run-time error.       [3 marks]

(*c*)  In the context of parameter-passing mechanisms, give one reason why pass-by-value is preferable to pass-by-reference or *vice versa*, from the point of view of the programmer.       [2 marks]

(*d*)  Give an example of the following constructs

    (*i*)  signature       [3 marks]

    (*ii*)  functor       [3 marks]

    in the SML Modules language.

(*e*)  (*i*)  In the programming language Scala, a generic class like the following one

```
abstract class Stack[A] {
  def push( x:A ): Stack[A]
  def top: A
  def pop: Stack[A]
  }
```

    is *non-variant* by default. Why?       [3 marks]

    (*ii*)  Modify the above abstract class to make it *co-variant*.       [3 marks]