Concepts in Programming Languages

(a) Give one difference and one similarity between the programming languages:

(i) Algol and SIMULA [2 marks]

(ii) LISP and Smalltalk [2 marks]

(b) What is the type of the expression `fn f => fn x => f(f(x))` inferred by the SML interpreter? Explain your answer. [6 marks]

(c) Give an example in the SML Modules language of two distinct signatures, say IN and OUT, and of a functor that takes structures matching IN to produce structures matching OUT. [6 marks]

(d) Comment on the mechanism for parameter-passing in the programming language Scala. [4 marks]

You may wish to consider the following two code samples.

```scala
def whileLoop( cond: => Boolean )( comm: => Unit )
{ if( cond ) comm; whileLoop( cond )( comm ) }

= if( xs.length <= 1 ) xs else
{ val pivot = xs( xs.length/2 )
  Array.concat
  ( qsort( xs filter (x => x.lt(x,pivot)) ) ,
  xs filter (x => x == pivot ) ,
  qsort( xs filter (x => x.lt(pivot,x)) ) ) }
```