COMP313-11A Test 1

13 April 2011

First name: _____ **Last name:** _____

ID Number: _____

Instructions

1. Write your name and ID number into the spaces provided above.
2. All four questions are of equal value and have to be answered.
3. Time allowed is 50 minutes.
4. Write your answers in the spaces provided. Do not use your own paper! There is also a blank page at the end of the test that you can use in addition, should you need more space.

This is a CLOSED BOOK test.

Do not turn the page until asked to do so, please.

Question 1: Tail recursion optimization

Explain tail recursion optimization (TRO) (also called last call optimization / LCO) is?

Does Java provide for TRO (simply state YES or NO)?

Does Scala provide TRO (simply state YES or NO)?

Does Prolog provide TRO (simply state YES or NO)?

Question 2: Objects

Almost everything is an `Object` in Java, but Java also includes 8 "primitive" data types. Why have the Java designers included primitives?

What about Ruby, Io, or Scala, is everything an object in these languages, or not?

Question 3: Memory Management

- List two advantages and two disadvantages of reference counting.

- For a specialised mathematical programming language like MatLab, Mathematica or similar, where basically the only data type used are multi-dimensional numeric arrays, would reference counting be appropriate? Explain your answer.

- Explain the purpose of the "nursery" in generational garbage collection. Given current processor architectures, what is a good size for the "nursery"?

Question 4: Unification in Prolog

For the following unification attempts, state whether they succeed or fail. In case of success, if any logical variables are bound to some value, list these. This question assumes SWI-Prolog, in cases where that would matter.

- a(1,2,3) = a(1,2,3).

- a(X,2,3) = a(Y,2,Z).

- a(1,2,3) = a(X,2,X).

- a(X,2,c(6)) = a(b(4,5),Y,Z).

- a(X,X,3) = a(Z,f(Z),3).

Extra space if needed for any of the above questions.