University of Toronto Mississauga Department of Mathematical and Computational Sciences CSC 324 — Principles of Programming Languages, Spring 2009

Midterm Test

| | Na | me: | | | | | | | |
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| , | Stu | ıdent Num | nber: | : | | | | | |
| ot | e: | Closed bo | ok. | 50 minutes. | 6 pages. | 4 questions. | 48 marks. | All Scheme and MI | L programs |

Note: Closed book. 50 minutes. 6 pages. 4 questions. 48 marks. All Scheme and ML programs should be written in good functional-programming style. Write all answers on the test booklet, using the back of pages if necessary. Good luck!

If you do not know the answer to a question, and you write "I don't know", you will receive 20% of the marks of that question. If you just leave a question blank with no such statement, you get 0 marks for that question.

1. (12 marks) Define a scheme function (maxPos E) that takes a nested list E as input and returns the largest positive number mentioned in E. If E contains no positive numbers, then return 0. For example,

2. (12 marks total) Consider the following pair of Scheme functions:

(a) (5 marks) In ten words or less, describe what g does. (Only the first ten words of your answer will be graded.)

(b) (1 mark) Give an example of what g does.

(c) (5 marks) In ten words or less, describe what f does.

(Only the first ten words of your answer will be graded.)

(d) (1 mark) Give an example of what f does.

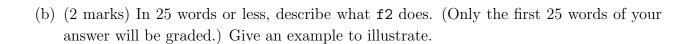
3. (12 marks total)

(a) (8 marks) What is the type of each of the following ML functions (2 marks each):

fun
$$f1(X,Y,Z) = (1+X+Y,Z);$$

fun
$$f3(g,X,h,Y) = h(X,g(Y));$$

fun
$$f4(f,g,h) = (fn X \Rightarrow h(g(f X)));$$



(c) (2 marks) In ten words or less, describe what f4 does. (Only the first ten words of your answer will be graded).

4. (12 marks total)

(a) (2 marks) Define employee to be a named type for records, where each record has four fields: id, name, age, salary. These four fields contain an integer, a string, an integer, and a real number, respectively.

(b) (10 marks) Define an ML function avgSal(L) that takes a list L of employee records, and returns the average salary of the employees. If L is empty, then return a negative number. For full marks, you should use pattern matching whenever possible.