Programming Languages [Fall 2014]
Practice Test II

NAME: _____

Instructions:

1) This test is 4 pages in length.

2) You have 75 minutes to complete and turn in this test.

3) Short-answer questions include a guideline for how many sentences to write. Respond in complete English sentences.

4) This test is closed books, notes, papers, friends, neighbors, etc.

5) Use the backs of pages in this test packet for scratch work. If you write more than a final answer in the area next to a question, circle your final answer.

6) Write and sign the following: "I pledge my Honor that I have not cheated on this test."

_____

_____

Signed: _____

1. [10 points]
What is a programming language? [1-2 sentences]

2. [20 points]
a) Write a function f that takes a list L and returns an option containing the last item in L (if one exists); if L is empty then f returns NONE. Use ML syntax but do not include any calls to predefined functions (such as *map*, *rev*, *foldl*, or *foldr*).

b) What is the type of f?

3. [15 points]
What are three benefits of type systems? [1-3 sentences]

4. [15 points]
Define an ML datatype for expressions in the untyped lambda calculus.

5. [39 points]   For all the following, (1) assume that correct definitions of values and capture-avoiding substitution already exist and (2) do not give names to your rules.

a) Define a call-by-value dynamic semantics for λ_{UT} with a *left-to-right* evaluation order.

b) Define a call-by-value dynamic semantics for λ_{UT} with a *right-to-left* evaluation order.

c) Define a call-by-name dynamic semantics for λ_{UT}.

d) Define a full-beta-reduction dynamic semantics for λ_{UT}.

6. [1 point] Prove the Preservation-Theorem case for diML function-application β-steps.