CSCE 330 Fall 2000
SECOND MIDTERM EXAM
Monday 00/11/20—Two Pages, Open Book

1. Name one functional language that does not have variables (1 points).

2. These questions refer to the FP language.

   (a) What is hd @ tl:<1,2,3,4>? (2 points)
   (b) What do you call the @ symbol? (2 points)
   (c) Describe in English the function hd @ tl. Be brief! (2 points)
   (d) What is !*:<2,3,4>? (2 points)
   (e) What do you call the ! symbol? (2 points)

3. These questions refer to the ML language.

   (a) What does the sml interactive system display in place of type1, type2, and type3 in the session fragment copied below? (3 points)

   ```
   opal.cs.sc.edu> sml
   Standard ML of New Jersey, Version 110.0.3, January 30, 1998 [CM; autoload
   enabled]
   - false;
   val it = false : type1
   - 2.0 + 3.0;
   val it = 5.0 : type2
   - "five";
   val it = "five" : type3
   -
   ```

   Recall that op= is the prefix version of =. What are type1, type2, and type3 in the following? (Be as general as possible!) (3 points)

   ```
   - op=;
   val it = fn : type1 * type2 -> type3
   -
   ```

   (b) In the if <test> then <then-part> else <else-part> form, does ML evaluate <test>, <then-part>, and <else-part> by need (*lazy evaluation*) or by value (*eager evaluation*)? (2 points)

   (c) Write a function zip that pairs corresponding members of two non-empty lists of equal size, e.g., zip ([1,2,3], ["a","b","c"]) is [(1,"a"),(2,"b"),(3,"c")]. Your function does not need to work if one or both of the argument lists are empty or if the arguments are lists of unequal size, (Hint: This is a function for which you may find the recursive case easier than the basis case!) (10 points)

(d) Do Exercise 3.3.2 on p. 75 of [Ullman] (10 points).

(e) Use simpleMap to multiply every element of an integer list by three (3 points).

(f) Use the "real" version of Map (cf. Figure 5.21 in [Ullman]) to multiply every element of an integer list by three (3 points).

(g) Write uncurried and Curried versions of simpleMap. (The uncurried version of simpleMap is on p.160 [Ullman].) Give the types of each version. (5 points).