Programming Languages G22.2110 Spring 2007 hw03

Assigned Tu 1/30/2007, due We 2/7/2007 at 1pm.

How to Submit Homework Assignments

Email your answers, in either plain text format or as pdf, to Long Lin <llin@cs.nyu.edu>. Assignments are due on Wednesdays at 1pm. This deadline will be strictly enforced.

Reading Assignments

- For lecture on 1/30/2007: Scott 7.8, 10.1-10.3
- For lecture on 2/6/2007: Scott 3.1-3.3

Homework Assignments

1. (6 points) Consider the following Scheme definition for function m:

```
(define (m ls) (if (null? ls) 1 (* (car ls) (m (cdr ls)))))
```

Indicate which function or special form was applied for each of the fifteen rewrite steps below.

```
(m '(3 5))
[1] => (if (null? '(3 5)) 1 (* (car '(3 5)) (m (cdr '(3 5)))))
[2] => (if #f 1 (* (car '(3 5)) (m (cdr '(3 5)))))
[3] => (* (car '(3 5)) (m (cdr '(3 5))))
[4] => (* 3 (m (cdr '(3 5))))
[5] => (* 3 (m '(5)))
[6] => (* 3 (if (null? '(5)) 1 (* (car '(5)) (m (cdr '(5)))))
[7] => (* 3 (if #f 1 (* (car '(5)) (m (cdr '(5)))))
[8] => (* 3 (* (car '(5)) (m (cdr '(5)))))
[9] => (* 3 (* 5 (m (cdr '(5)))))
[10] => (* 3 (* 5 (m '())))
[11] => (* 3 (* 5 (if (null? '()) 1 (* (car '()) (m (cdr '())))))
[12] => (* 3 (* 5 (if #t 1 (* (car '()) (m (cdr '())))))
[13] => (* 3 (* 5 1))
[14] => (* 3 5)
[15] => 15
```
2. (14 points) Consider the following Scheme definition for function \( r \):

\[
(\text{define } (r \text{ ls}) (\text{if } (\text{null?} \text{ ls}) '() (\text{append } (r \text{ (cdr ls)}) \text{ (list } (\text{car ls}))))))
\]

Show how Scheme evaluates the expression \((r \text{ '(3 5)})\) by rewriting it similar to Question 1 above (you should end up with 17 rewrite steps).

3. (9 points) Show three different error messages you encountered while answering Question 4 below. For each of them, distill a very short example for what causes it.

4. Continue teaching yourself Scheme by doing the following. In your answers, use only functions that are listed in Section 6 (Standard procedures) of the Revised(5) Report on Scheme. These should be available both in DrScheme (language level R5RS) and in guile.

4a. (7 points) Write a small example program using I/O. Your program should read one string of user input from stdin. It should write the number of characters of the string, and the string itself, to stdout. This program should terminate after the first input, without prompting for more. Here is an example interactive session:

"note the double-quotes"
22 characters, note the double-quotes

4b. (7 points) Write a small example program using types. For each line of output below, your program should first create a variable with the specified name, type, and value, and then print that variable. The output should look like this:

name i, type int, value 42
name c, type char, value Z
name str, type string, value hello
name sym, type symbol, value *
name l, type list, value (1 4 9 16)
name f, type float, value 3.141
name b, type boolean, value #t

4c. (7 points) Write a small example program using control flow. Your program should contain an if expression, a cond expression, two function definitions (one non-recursive function and one recursive function), and calls to both functions.

5. (0 points) Practice your Python skills by writing some more code. For example, you could solve problems from other classes in Python. If you need inspiration, take a look at the Examples section on the class web page, which lists extension ideas for code used in this class.

http://www.cs.nyu.edu/courses/spring07/G22.2110-001/hw03.pdf
Total points: 50.