Homework 7 — ML core language— due Monday 15 April

Total number of points available on this homework is 150. Full credit is equivalent to 100 points.

Reading assignment

Read Chapter 5 of *ML for the Working Programmer*.

7.1 Types (80pts)

The following is a correct block of ML code from which some pieces have been excised.

missing piece 1

```
type e = t * t

fun e (A x, A y) = x = y
  | e (B (x, v), B (y, w)) =
      x = y
      andalso (List.length v = List.length w)
      andalso List.foldr (fn (x, y) => e x andalso y)
                         true (ListPair.zip (v, w))
  | e _ = false

fun ee ((x, v), (y, w)) =
   e (x, y) andalso e (v, w)
```

missing piece 2

```
fun a [] e = e
  | a (v::w) e = c v (a w e)
```

Missing piece 1 is the declaration of `t`, and missing piece 2 is the declaration of `c`.

When we type in the whole block of code into SML/NJ, the following is reported (some lines omitted):

```
type e = t * t
val e = fn : t * t -> bool
val ee = fn : (t * t) * (t * t) -> bool
val a = fn : e list -> e list -> e list
```

1. (20pts) Give a complete possible declaration of `t`.
2. (20pts) What must be the type of `c`?
3. (20pts) Describe in words the purpose of the function `e`. Under what conditions on `x` does `e x` evaluate to `true`?
4. (20pts) Describe in words the purpose of the function `ee`. Under what conditions on `x` does `ee x` evaluate to `true`?

7.2 Input and output (20pts)

In exercises 6.4 and 6.5, we wrote the functions `parse: string -> expr` and `eval: expr -> int`. Learn how to read a string from standard input, and how to write an integer to standard output. Write a function `calc: unit -> unit` which accepts from the user a string supposed to contain an arithmetic expression, parses it using `parse`, evaluates the expression using `eval`, and prints the value. If there is a syntax error in the input, the error should be reported to the user.

7.3 Using lists for arithmetic (50pts)

This exercise is a continuation of exercise 6.8.

1. (30pts) Write a function for exponentiation of a numeral in any radix (e^x).
2. (20pts) Evaluate e to 1000 decimal digits of precision.

How to turn in

Turn in your code by running

~dmykola/handin your-file

on a regular UNM CS machine.

You should use whatever filename is appropriate in place of your-file. You can put multiple files on the command line, or even directories. Directories will have their entire contents handed in, so please be sure to clean out any cruft.

Remember to submit extensive tests of your programs!

Homework must be accompanied by the following statement: *"I pledge my honor that in the preparation of this assignment I have complied with the University of New Mexico Board of Regents' Policy Manual, including Section 4.8, Academic Dishonesty."* The manual is available at `http://www.unm.edu/~brpm/index.html`.