CPSC 201: Introduction to Computer Science Carsten Schürmann Date: January 21, 2003

## Homework 1

Due: Wednesday, January 22, 2003.

## Guidelines

While we acknowledge that beauty is in the eye of the beholder, you should nonetheless strive for elegance in your code. Not every program which runs deserves full credit. Make sure to state invariants in comments which are sometimes implicit in the informal presentation of an exercise. If auxiliary functions are required, describe concisely what they implement. Do not reinvent wheels, and try to make your functions small and easy to understand. Use tasteful layout and avoid long winded and contorted code. None of the problems requires more than a few lines of SML code.

**Exercise 1** You are the owner of a paint shop called *Paint Paradise*. Your assortment includes a few base colors, red, blue, and green, and with a special color mixing system with which you can generate other colors

- 1. How many colors can you obtain from mixing the three base colors to equal parts?
- 2. Define a datatype Color for your colors. Be creative, give them good names!
- 3. Implement a mixing function for two colors

mix : Color \* Color -> Color

4. Run your program on two inputs.

mix (Green, Red)
mix (Blue, Blue)

5. Extra Credit: How many colors can you obtain from mixing the three base colors in two to one parts?

**Exercise 2** Obviously, color perception is a very subjective sense. If a customer returns to your store *Paint Paradise* and wants a refill of a certain color, it is best identified by an identified using a number. One way this can be established is by translating each of the base colors red, green, and blue into values  $c_1$ ,  $c_2$ , and  $c_3$ , respectively, of type int. Any paint consists of  $n_1$  parts red,  $n_2$  parts blue, and  $n_3$  parts green. With well chosen values  $n_i$ , the identifying number can be computed by the following formula.

$$id(n_1, n_2, n_3) = c_1^{n_1} c_2^{n_2} c_3^{n_3}$$

- 1. Think of three numbers  $c_{\rm red},\,c_{\rm blue},$  and  $c_{\rm green},\,{\rm s.t.}$  the corresponding identity number is unique.
- 2. Justify your choice of numbers.
- 3. Implement the function

id : int \* int \* int -> int.

You may use the following given exponentiation function:

fun exp x n = if n = 0 then 1 else (exp x (n-1)) \* x

4. Extra credit: Can you write the inverse function, the function that takes an id number as input and computes the parts of the three base colors as output?

color : int -> int \* int \* int