MA 151: Homework #7

due Tuesday November 3

Written problems

In each of these, simplify the expressions step-by-step to get the final value. If there is an error, say exactly what the problem is. If the function gives an infinite loop, explain in general terms what the output will be. You should show enough detail to make it clear that you know what is going on. In all cases, you should be able to check your answer by typing the expressions into GHCi.

1. \(\text{zipWith} \ ($$) \ (\text{repeat} \ \text{succ}) \ [1..5]\)
2. \(\text{foldr} \ ($$) \ 3 \ [\text{succ}, \ (\text{^2}), \ \text{pred}])
3. \(\text{foldr} \ (\lambda x \ y \rightarrow 2\cdot x + 3\cdot y) \ 1 \ [1,2,3,4]\)
4. \(\text{foldl} \ (\lambda x \ y \rightarrow 2\cdot x + 3\cdot y) \ 1 \ [1,2,3,4]\)
5. \(\text{foldr} \ \text{map} \ [1,2,3] \ [(*2),\text{pred}, \ (\text{^-2}), \ \text{succ}]\)

Programming problems

- Rewrite the \texttt{summa} function from Homework 5 using a fold. I suggest something like:

\[
\text{summa} \ \texttt{xs} = \text{foldr} \ (+) \ ___ \ \texttt{xs}
\]
where \(f \ a \ b = ______\)

(For the definition of \(f\), it should do \(a + b\) when \(a\) is even, and something else when \(a\) is odd.)

- Use functions from the Data.String module to write a function called \texttt{wordCount} that takes a big string with spaces and counts the number of words in it. Use Hoogle to find the functions you need. Make your definition points-free.

- Write a function called \texttt{ratLeq} which takes two parameters of type \texttt{Rat} (use the type declaration from class on 10/24) and returns a Boolean telling whether or not the first parameter is less than or equal to the second. (Hint: rethink this inequality: \(\frac{a}{b} \leq \frac{c}{d}\) by multiplying denominators across.)

For the following functions, use the following data declaration for quadratic polynomials with integer coefficients:

```haskell
data Quad = Coeffs Int Int Int deriving Show
```
The idea for this type is that \texttt{Coeffs 3 2 (-7)} represents the polynomial \(3x^2 + 2x - 7\).

- Write a function called \texttt{quadEval} which evaluates a polynomial at a particular \(x\)-value. For example:

\[
\text{quadEval} \ (\text{Coeffs} \ 3 \ 2 \ (-7)) \ 2 \ \text{is} \ 3 \cdot 2^2 + 2 \cdot 2 - 7 = 9
\]

- Write a function called \texttt{quadAdd} which adds together two \texttt{Quads}.

- Write a function called \texttt{quadMult} which takes two \texttt{Quads} and attempts to multiply them. If the result is not a quadratic polynomial, your function should return 0 (the constant polynomial 0).