CMPT 383 Comparative Programming Languages

Homework 2

This homework is due by 11:59pm PT on Wednesday Feb 2, 2022. No late submission is accepted. Please save your Haskell code in a single file called `h2_firstname_lastname.hs` (`h` in lower case, firstname and lastname replaced with your first and last name) and submit it to Canvas.

Requirements of this homework:

- Write type signatures for all functions using the :: operator.
- Do not use the `if-then-else` expression unless specified in the question.

1. (20 points) Write a tail-recursive function `sumTailRec` that takes a list of numbers and returns their sum.

Sample input and output:

```
ghci> sumTailRec [1..10]
55
ghci> sumTailRec [1, 2.1]
3.1
```

2. (10 points) Write a recursive function `myFoldl` that implements the standard `foldl` for lists.

Sample input and output:

```
ghci> myFoldl (+) 0 [1,2,3,4]
10
ghci> myFoldl (flip (:)) "" "abcd"
"dcba"
```

3. (10 points) Write a recursive function `myFoldr` that implements the standard `foldr` for lists.

Sample input and output:

```
ghci> myFoldr (*) 1 [1,2,3,4]
24
ghci> myFoldr (:) "" "abcd"
"abcd"
```

4. (20 points) Write a function `alternativeMap :: (a -> b) -> (a -> b) -> [a] -> [b]` that alternatively applies two argument functions to elements in the list.

Sample input and output:

```
ghci> alternativeMap (+10) (+100) [1]
[11]
ghci> alternativeMap (+10) (+100) [1..6]
[11,102,13,104,15,106]
```

5. (20 points) Write a function called `myFilter` using `foldl` to implement the standard `filter`. Note that you can use `if-then-else` for this question.

Sample input and output:

```
ghci> myFilter even [1..10]
[2,4,6,8,10]
ghci> myFilter (>5) [1..10]
[6,7,8,9,10]
```

6. (20 points) Write a function `sumsqeven` in point-free style that takes a list of `Int`'s and returns the sum of squares of all even numbers in the list. Hint: you may want to use the section `(^2)` somewhere in the code.

Sample input and output:

```
ghci> sumsqeven [1,2,3,4]
20  -- 2^2 + 4^2 == 20
ghci> sumsqeven [2,4,6]
56  -- 2^2 + 4^2 + 6^2 == 56
```