Haskell & Functional Programming

If you want a feedback about your solutions to the proposed exercises, collect all solutions in a single file and send it by email to Andrea Corradini (andrea@di.unipi.it) and/or Matteo Busi (matteo.busi@di.unipi.it)

Exercise 1

Write a function `myReplicate` that given an integer `n` and a value `v` returns a list of *length* `n` initialized with `v`, namely all elements are equal to `v`.

- **Goal:** Warming up!
- **Expected output:** Two implementations of `myReplicate`: one recursive and one using the combinators `map`, `filter`, `foldl/r` from the Haskell Prelude.

Exercise 2

Write a function `sumOdd` that given a list of integers computes the sum of the values that are *odd*.

Hint: consider the functions `odd` and `even` of the `Prelude`.

- **Goal:** Warming up (part 2)!
- **Expected output:** Two implementations of `sumOdd`: one recursive and one using the combinators `map`, `filter`, `foldl/r` from the Haskell Prelude.

Exercise 3

Write a function `repl` that given a list `xs` and a integer `n` returns a list containing the elements of `xs` replicated `n` times.

Hint: you can use the function `myReplicate` of Exercise 1.

- **Goal:** Playing with lists.
- **Expected output:** Two implementations of `repl`: one recursive and one using the combinators `map`, `filter`, `foldl/r` from the Haskell Prelude.

Exercise 4

Write a function `totalLength` that given a list of strings `xs` computes the sum of the lengths of the strings starting with the character '`A`'.

- **Goal:** Test your skills with lists and strings.
- **Expected output:** Two implementations of `totalLength`: one recursive and one using the combinators `map`, `filter`, `foldl/r` from the Haskell Prelude.

Exercise 5

Write a function `filterOdd` that given a list `xs` returns a new list obtained from `xs` by removing the elements at odd positions.

Hint: Here "odd positions" means the first, third, fifth, etc position.

- **Goal:** Playing with lists (part 2).

- **Expected output:** Two implementations of `filterOdd`: one recursive and one using the combinators `map`, `filter`, `foldl/r` from the Haskell Prelude.

Exercise 6

Write a function `titlecase` that given a string `s` converts it to *titlecase* by uppercasing the first letter of every word.

Hint: consider using the function `words`, `unwords` of the `Prelude` and the function `toUpper` of the module `Data.Char`. To make accessible this last function in your code use `import Data.Char (toUpper)`.

- **Goal:** Experimenting with strings.
- **Expected output:** Two implementations of `titlecase`: one recursive and one using the combinators `map`, `filter`, `foldl/r` from the Haskell Prelude.

Exercise 7

Write a function `countVowelPali` that given a list of strings `xs` returns the total number of vowels in strings that are palindromes. For example,

```
countVowelPali ["anna", "banana", "civic", "mouse"] = 4
```

- **Goal:** Fun with strings and lists (again :P).
- **Expected output:** Two implementations of `countVowelPali`: one recursive and one using the combinators `map`, `filter`, `foldl/r` from the Haskell Prelude.

Exercise 8

Recall the higher-order combinator `map` from the `Prelude`. Implement it using the combinator `foldl`.

- **Goal:** Experimenting with combinators.
- **Expected output:** The required implementation of the `map` combinator.

Exercise 9

Consider the following definition of binary trees:

```
data IntTree = Leaf Int | Node (Int, IntTree, IntTree)
```

1. Implement `tmap`, a "tree version" of the `map` combinator. More precisely, the function `tmap` should take a function `f` and a tree `t` and should apply `f` to each value in `t`.
2. Using `tmap` implement the function `succTree` taking a tree `t` and computing a tree whose elements are the successors of the values in `t`.
3. Write a function `sumSucc` taking a tree `t` and computing the sum of the elements of `succTree t`.

- **Goal:** Experimenting with trees.
- **Expected output:** An implementation of the three required functions.

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