Functional Programming

example exam

1. (2+2)

   a) Please define a function `delete_all x l` eliminating all occurences of `x` in the list `l`.

   b) Please define a function `flatten l` transforming the list of lists `l` into a flat list. Przykład:
   ```
   > flatten [[1,2,3],[8,9],[4,6]]
   [1,2,3,8,9,4,6]
   ```

2. (2+2+2+1)

   Please define a function `filter p l`, whose value is the list of elements of `l` fulfilling predicate `p`

   a) using recursion.

   b) using set comprehension,

   c) using an appropriate higher order function (except for `filter` of course :-).

   d) What is the type of function `filter`?

3. (2+3+2+3+4)

   Assume that the following type for trees is given.

   ```
   data Tree a = Nil | Node a (Tree a) (Tree a)
   ```

   a) Please define a function `tree_size t`, whose value is the height of tree `t`.

   b) Please define a function `tree_max`, whose value is the biggest element of tree `t`.

   c) Please define a function `tree_map f t` applying function `f` to all elements of tree `t`.

   d) For trees having lists as elements, please define a function `tree_length t` adding to each node's element in `t` the length of its corresponding list.

   e) What are the most general types of the functions defined in a) - c)?

4. (3)

   Please compute the most general type of the following expression.

   $$\backslash x \longrightarrow f\ x\ y$$