

**Assignment 2**  
**Advanced Functional Programming**  
**Topics: Generator/Selector-Principle**  
**Issued on: 04/20/2007, due date: 04/27/2007**

For this assignment a Haskell script named `AssFFP2.hs` shall be written offering functions which solve the problems described below. This file `AssFFP2.hs` shall be stored in your home directory, as usual on the top most level. Comment your programs meaningfully. Use constants and auxiliary functions, where appropriate.

- The value of the exponential function  $\exp$  at point  $x$  is approximated by the series

$$\exp x = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots$$

Implement a Haskell function `exps :: Float -> [Float]`, which yields the stream of  $k$ -prefixes approximating the value of  $\exp$  at  $x$ . This means, the output of `exps` shall be the stream  $[1, 1 + \frac{x}{1!}, 1 + \frac{x}{1!} + \frac{x^2}{2!}, \dots]$ .

- Implement a Haskell function `expskPref :: Int -> Float -> Float`, which, if applied to  $k$ ,  $k \in \mathbb{N}$ , and  $x$  yields the  $k$ -prefix of `exp x`. This means, if  $k = 1$ , `expskPref` then yields the value 1. If  $k = 3$ , it yields the value of the expression  $1 + \frac{x}{1!} + \frac{x^2}{2!}$ .
- Let  $m, n, p \in \mathbb{N}$ . The triple  $(m, n, p)$  is called a *Pythagorean triple*, if  $m \leq n \leq p$  and  $m^2 + n^2 = p^2$ . Write a Haskell function `pythTriples :: [(Integer, Integer, Integer)]`, which yields the stream of all Pythagorean triples, which shall be ordered in the following fashion: The components of each triple are in ascending order; a triple  $t_1$  occurs earlier in the stream than a triple  $t_2$ , if the third component of  $t_1$  is smaller than that of  $t_2$ , i.e. `pythTriples` equals the stream  $[(3, 4, 5), (6, 8, 10), (5, 12, 13), (9, 12, 15), \dots]$ .
- Implement a function `primePytTrp :: Int -> [(Integer, Integer, Integer)]`, which, depending on the value of its argument  $n$  yields a substream of the set of Pythagorean triples. If  $1 \leq n \leq 3$ , it yields the substream of triples, where  $n$  or more components of the triple are prime. Otherwise, it yields the empty list.