

# Tutorium Funktionale Programmierung 2019

Part 8 - Higher-Order-Functions,  
Partial Application, “(.) and (\$)” and  $\lambda$  Abstraction

VO - Part 4

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- Which topics should be discussed once more?
  - Questions.
  - Wishes for the tutorial 2019-12-3.
- ▶ Arsnova
- ▶ Session:
- 50 09 60 50**

# Partial Application

(e.g. 1) *drop3* = *drop 3*

(e.g. 2) *multi2* = *(\*2)*

- ▶ Produce another function with smaller arity

# Higher-Order-Functions

- ▶ “functions are just like any other value”
- ▶ takes other functions as input
- ▶ OR return a function as result
- ▶ used for abstraction

Ref. : [https://en.wikibooks.org/wiki/Haskell/Higher-order\\_functions](https://en.wikibooks.org/wiki/Haskell/Higher-order_functions)

## 8.1. Exercise: Higher-Order-Functions

You want receive the absolute value of a given function at a specific point. Something like *myAbs*:  $(f, x) \rightarrow |f(x)|$ . A function *f* has the following type

*f* :: Double -> Double

Create a **high-order-function** for the *myAbs* and test it with  $g\ x = x^2 - 4$  and  $x = 0$  as well as  $x = 3$ .

## 8.2. Exercise: Function Composition and Function Application

Use the minimal amount of parentheses for

`(null (tail (tail [True, False]))) == (not (not False))`

- ▶ Use `(.)`
- ▶ Use `($)`

# $\lambda$ -Abstraction

e.g. `average = \ x y z -> (abs(x)+abs(y)+abs(z))/3`

- ▶ anonymous function - “have no name”
- ▶ Written `\ ... ->`





## 8.3. exercise: $\lambda$ -Abstraction, Higher-Order-Functions and Partial Application CONTINUED

1. Express a function *myMap* that takes a function  $f :: a \rightarrow b$  and a list of type `[a]`. The function  $f$  is applied to each element of the list. (**Higher-order-function**)
2. Create a function *newRate* that takes as input a list of passbooks, an annual interest rate and a returns a list with the calculated value. You should use the function *myMap* in combination with  **$\lambda$  abstraction**.
3. Define a function with a fixed annual rate of 0.03 called *annualRate003*. Use **partial application**.

Questions? Need help? Feedback? etc.

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