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## Essentials of Programming Languages

<http://proglang.informatik.uni-freiburg.de/teaching/konzepte/2015/>

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### Exercise Sheet 10

#### 10.1 Recursive Functions

In the lecture, recursive functions were introduced:

$$e ::= \dots \mid \lambda f x.e$$

Extend your syntax definitions to support recursive functions.

#### 10.2 Objects

We want to have objects in our language. That is, we add the following syntactic elements:

$$e ::= \dots \mid \mathbf{new} \mid e.x \mid e.x(e) \mid e.x := e \mid \mathbf{this}$$

The expression  $e.x(e)$  represents a method call. The first expression should evaluate to an object, the second expression to an argument.  $e.x$  represents a field access and should return the value of the field if it exists. The expression  $e.x := e$  represents an assignment to a field. The first expression should evaluate to an object the second to the new value of the field. Finally, the **this** expression represents the current object. It is only valid within a method.

#### 10.3 Prototype Inheritance

We want to have object inheritance in our language. That is, we add the following syntactic element:

$$e ::= \dots \mid \mathbf{new} e$$

Expression **new**  $e$  first evaluates  $e$  to an object and creates a new empty object with the evaluated objects set as prototype. Read access  $e.x$  should forward the operation to the prototype if  $x$  is not locally present.

### Submission

**Deadline** The submission deadline is **17.07.2015, 12:00 (noon)**. Late submissions will not be accepted. Submit your solution to the subversion repository.

**Submission** Your solution will consist of one *folder* (**exercise10**) for each exercise sheet. Submit one *pdf* file (**<name>\_exercise10\_<nr>.pdf**) and one *rkt* file (**<name>\_exercise10\_<nr>.rkt**) per exercise.

Your solution may be either in German or in English. Clear and understandable style is required. You are strongly encouraged to test your solution. Your code must compile without errors (which did not necessarily mean that everything has to work). Provide your source code with comments to understand the intention.