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Summer term 2008

Software Engineering

http://swt.informatik.uni-freiburg.de/node/94
http://proglang.informatik.uni-freiburg.de/teaching/swt/2008/

Exercise Sheet 1

2008-05-02

Exercise 1 (Javascript; (1+1+1) Points)
Given the following Javascript code:

```
s = "some string";
s.x = 13;
s.x;
```

(a) Download the Javascript interpreter Rhino from

`http://www.mozilla.org/rhino/download.html`

and use it to execute the code given. (The interpreter is started with the command `java -jar js.jar` where the file `js.jar` is part of the `.zip` file you have downloaded.)

What results prints Rhino?

(b) Change the first or second line of the example, so that the third line (`s.x`) now prints `13`.

(c) Explain the behavior you observe. What would you suggest to prevent such mysterious bugs from happening?

Exercise 2 (Types for JAUS; (1+1+1+1+1) Points)
Which of the following JAUS expressions are type correct? Give a typing derivation for all type correct expressions.

(a) $1 + \texttt{false}$

(b) $13 + (47 + 11)$

(c) $!(!\texttt{true})$

(d) $z + x$

(e) $!z$

(For (d) and (e), we assume that x has type `int` and z has type `boolean`.)

Exercise 3 (Evaluation of JAUS; (2+1) Points)
Evaluate the following JAUS expressions as far as possible.

(a) $13 + (47 + 11)$

(b) $(1 + 1) + \texttt{false}$

Which of the resulting expressions are values?

Exercise 4 (Type soundness; 8 Points)
Prove the following theorem:

If $\vdash e_0 : t$ *then there exists a value* e_n *such that* $\vdash e_n : t$ *and*

$$e_0 \longrightarrow e_1 \longrightarrow e_2 \longrightarrow \ldots \longrightarrow e_{n-1} \longrightarrow e_n \quad .$$

Hint: The following lemma might be helpful. You do not need to prove it.

Lemma 1 (Normalization)**.** *For every expression* e_0*, there exists an expression* e_n *such that*

$$e_0 \longrightarrow e_1 \longrightarrow e_2 \longrightarrow \ldots \longrightarrow e_{n-1} \longrightarrow e_n$$

and no expression e_{n+1} *exists with* $e_n \longrightarrow e_{n+1}$.

Exercise 5 (Featherweight Java; 3 Points)
Given the following Featherweight Java program:

```
class Author extends Object {
  String firstName;
  String lastName;

  Author(String firstName, String lastName) {
    super();
    this.firstName = firstName;
    this.lastName = lastName;
  }
}

class Book extends Object {
  Author author;

  Book(Author author) {
    this.author = author;
  }

  String getAuthorLastName() {
    return this.author.lastName;
  }
}
```

(We liberally extend Featherweight Java with support for strings: The class `String` is the type for string literals of the form `"This is some string"`.)

Now evaluate the expression

```
new Book(new Author("Benjamin", "Pierce")).getAuthorLastName()
```

List all intermediate results and explain for every reduction step which reduction rule you have used.

Submission: 2008-05-09, 12pm **before** the exercise session in HS 00-036, building 101.