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Software Engineering

Exercise Sheet 1

Exercise 1: Javascript (3 Points)

Given the following Javascript code snippet:

```
s = "some random string";
s.x = 42;
s.x;
```

1. Download the Javascript interpreter Rhino from

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

    and use it to execute the above Javascript code. The interpreter is started using the command `java -jar js.jar` where the file `js.jar` is part of the `.zip` file you have downloaded. What results prints Rhino?

2. Change the first or second line of the example, such that executing the third line (`s.x;`) prints 42.

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

Exercise 2: Types for JAUS (5 Points)

Which of the following JAUS expressions are type correct? Give a type derivation for all type correct expressions. Assume that variable x is of type `int` and variable y is of type `boolean`.

1. $1 + \text{true}$

2. $23 + (47 - 11)$

3. !(!false)

4. $y + x$

5. $!y$

Exercise 3: Evaluation of JAUS (4 Points)

Evaluate the following JAUS expressions as far as possible.

1. $23 + (47 - 11)$

2. $(1 + 1) + \text{true}$

Which of the resulting expressions are values?

Exercise 4: Type soundness (8 Points)

Prove the following theorem:

Theorem 1. *If* $\vdash e_0 : t$ *then there exists a value* e_n *such that* $\vdash e_n : t$ *and* $e_0 \longrightarrow e_1 \longrightarrow \ldots \longrightarrow e_{n-1} \longrightarrow e_n$.

Hint: The following lemma might be helpful. You don't need to prove it.

Lemma 1 (Normalization). *For every expression* e_0, *there exists an expression* e_n *such that* $e_0 \longrightarrow e_1 \longrightarrow \ldots \longrightarrow e_{n-1} \longrightarrow e_n$ *and no expression* e_{n+1} *exists with* $e_n \longrightarrow e_{n+1}$.