Programmiersprachen II

Tübingen, 18. Oktober 2018

In order to be admitted to the exam, you have to successfully submit your homework every week, except for 2 weeks. A successful submission is one where you get at least 1 point.

Handin  Please submit this homework until Thursday, October 25, either via email to Philipp Schuster (philipp.schuster@uni-tuebingen.de) before 12:00, or on paper at the beginning of the lab.

Groups  You can work in groups of up to 2 people. Please include the names and Matrikelnummern of all group members in your submission.

Points  For each of the Tasks you get between 0 and 2 points for a total of 6 points. You get:
- 1 point, if your submission shows that you tried to solve the task.
- 2 points, if your submission is mostly correct.

Task 1: Syntax

Consider the following language, given in BNF:

\[
\text{⟨term⟩} ::= \text{′squiggle′ (term)} \mid \text{′squaggle′ (term)} \mid \text{′sqop′} \mid \text{′transmogrify′ (term) (term)}
\]

Are the following terms in the language? (No proof required)

1. squiggle sqop
2. sqop sqop
3. transmogrify (squiggle squaggle) squiggle
4. squiggle (squaggle sqop)
**Task 2: Inference rules**

How could we define the set of terms (called $\mathcal{T}$) from Task 1 with inference rules? One inference rule would be for example:

$$
\begin{align*}
& t_1 \in \mathcal{T} \\
\Rightarrow & \text{squiggle } t_1 \in \mathcal{T}
\end{align*}
$$

Which of the inference rules are axioms?

**Task 3: Induction**

We define the sequence of sets $S_i$:

- $S_0 := \emptyset$
- $S_{i+1} := \{\text{sqop}\} \cup \{\text{squiggle } t, \text{squaggle } t \mid t \in S_i\} \cup \{\text{transmogrify } t_1 \ t_2 \mid t_1 \in S_i, t_2 \in S_i\}$

Prove by induction on $i$: $\forall i \in \mathbb{N} : S_i \subseteq S_{i+1}$