Software-Modellierung und Verifikation
Informatik 2
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7. Exercise sheet *Compiler Construction WS09/10*

Due on Wednesday, December 09, *before* the exercise class.

If possible, please submit your solution online to `chfalak@gmail.com`

Exercise 7.1:

The grammar G_{bool} is given as follows:

$$\begin{array}{lcll} S & \rightarrow & B & (0) \\ B & \rightarrow & (B \wedge B) \mid \neg B \mid t \mid f & (1,2,3,4) \end{array}$$

a) Compute the $LR(0)$ sets for G_{bool} using the power set construction.

b) Provide the $LR(0)$ parsing table for G_{bool}.

c) Derive the sequence of configurations that the $LR(0)$ parsing automaton visits on the input word $((\neg t \wedge f) \wedge (f \wedge t))$.

Exercise 7.2:

A formal language $L \subseteq \Sigma^\star$ is *prefix-free* iff $L \cap L\Sigma^+ = \emptyset$, that is, if no real prefix of a word in L is in L.

a) Prove that $L \notin \mathfrak{L}(LR(0))$ holds for all non-prefix-free languages L.
Hint: Use the $LR(0)$ parsing automaton for your proof.

b) Prove that the class *REG* of regular languages is incomparable (w.r.t. set inclusion) to the class $\mathfrak{L}(LR(0))$ of all languages that are generated by $LR(0)$ grammars.

Exercise 7.3:

Prove that $LALR(1) \subsetneq LR(1)$.

Exercise 7.4:

The language $L = \left\{a^{2^n} \mid n \in \mathbb{N}\right\}$ is not context free. Define an attribute grammar for the language $\{a^\star\}$ which indicates by a Boolean synthesized attribute of its start symbol, whether a derived word is in L. Only use simple functions like addition, multiplication and test for equality. In particular, avoid using a function which checks whether a given number is a power of two!
Construct the attribute equation system for the word a^4 and solve it!