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Compiler Construction 2016

— Series 5 —

Hand in until June 14th before the exercise class.

General Remarks

- It is allowed to hand in your solutions for the theoretical part via email **as a separately attached PDF file**.
- Please hand in your solutions in groups of 3 or 4.

Exercise 1 (2 Points)

A language $L \in \Sigma^*$ is called prefix-free, if $L \cap L\Sigma^+ = \emptyset$, i.e. if no proper prefix of a word in L is in L, too.

Show that the following holds for all non prefix-free languages L: $L \notin \mathfrak{L}(LR(0))$.

Exercise 2 (2 Points)

(a) Show that there exists an $LR(0)$ grammar that is not an $LL(1)$ grammar.

(b) Show that there are regular languages for which no $LR(0)$ grammars exist.

Exercise 3 (2 Points)

Consider the following grammar G:

$$\begin{aligned} S &\to A_1 b_1 \mid A_2 b_2 \mid A_3 b_3 \\ A_1 &\to a_2 A_1 \mid a_3 A_1 \mid a_2 \mid a_3 \\ A_2 &\to a_1 A_2 \mid a_3 A_2 \mid a_1 \mid a_3 \\ A_3 &\to a_1 A_3 \mid a_2 A_3 \mid a_1 \mid a_2 \end{aligned}$$

(a) Compute all $LR(0)$ sets of G.

(b) Prove or disprove: G is an $SLR(1)$ grammar.

Exercise 4 (4 Points)

Consider the grammar $G = (N, \Sigma, P, S')$ covering some boolean expressions:

- $N := \{S', S\}$
- $\Sigma := \{true, false, \wedge, \neg, (,)\}$
- $$\begin{array}{lcl} S' & \to & S \\ S & \to & (S \wedge S) \mid \neg S \mid true \mid false \end{array}$$

(a) Compute all $LR(0)$ sets of G.

(b) Specify the (deterministic) $LR(0)$ parsing automaton of G. Especially specify the parsing table. (Do not forget to give a numbering to the grammar rules.)

(c) Provide a run of the automaton on the input $((\neg true \wedge false) \wedge false)$.