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Compiler Construction 2017
— Exercise Sheet 5 —

Hand in until June 20th before the exercise class.

Exercise 1 (3 Points)

Consider the family of context-free grammars G_n ($n \in \mathbb{N} \setminus \{0,1\}$) that is given by:

$$\begin{aligned} S &\to A_i b_i && \text{for } 1 \leq i \leq n \\ A_i &\to a_j A_i \mid a_j && \text{for } 1 \leq i,j \leq n \text{ and } i \neq j \end{aligned}$$

Show that G_n has at least $2^n + n^2 + n$ sets of $LR(0)$ items.

Remark: In fact G_n has exactly $2^n + n^2 + n$ sets of $LR(0)$ items.

Exercise 2 (3 Points)

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

(b) Prove or disprove: There exists an $LL(0)$ grammar whose language is infinite.

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

Exercise 3 (3 Points)

Consider the following grammar G:

$$\begin{aligned} S' &\to S \\ S &\to Ac \mid cBa \\ A &\to aA \mid bA \mid a \mid b \\ B &\to cBa \mid ab \end{aligned}$$

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

(b) Prove or disprove: G is an $LR(0)$ grammar.

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