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COMPUTER SCIENCE

Compiler Construction WS15/16

Exercise Sheet 4

Exercise 4.1 LR(0)

Let the grammar $G = (\{S', S, A, B, C\}, \{a, b, c, d\}, P, S')$ with productions P:

$$
\begin{aligned}
S' &\rightarrow S \\
S &\rightarrow A\,B \mid A \\
A &\rightarrow a\,C\,c \\
C &\rightarrow b\,b\,C \mid b \\
B &\rightarrow c\,d
\end{aligned}
$$

1. Construct the $LR_0(G)$ automaton with the direct construction algorithm from the lecture.

2. Mark all inadequate states in the $LR_0(G)$ automaton. For each inadequate state you have to enumerate all the conflicts (each conflict is a pair of items) and classify them.

3. Is G an $SLR(1)$ grammar? Justify your answer.

4. Construct $LR_1(G)$ by adding lookahead sets. To keep your write-up short, only construct the $LR(1)$-items for the conflicting items in the $LR(0)$-inadequate states.

5. Give a successful run of the PDA $P_1(G)$ controlled by $LR_1(G)$ on the input word $w = a\,b\,b\,b\,b\,b\,c\,c\,d$. You can do this by creating a table containing columns for the current stack content, the remaining input and the next action. You do not need to formally specify $P_1(G)$. At which points of the run would there be conflicts if it was not for the lookahead sets added and why does your selection of the lookahead sets prevent these situations?

Exercise 4.2 LL(0) and LR(0)

Prove or disprove the following claims:

1. All LL(0) languages are also LR(0) languages.

2. All regular languages are LR(0).

3. Not all LR(0) languages are regular.

Exercise 4.3 Viable Prefixes

The grammar G is given by the productions

$$
\begin{aligned}
S &\rightarrow AB \\
A &\rightarrow aA \mid B \\
B &\rightarrow bB \mid c
\end{aligned}
$$

Which of the following strings are viable prefixes of a right sentential form (RSF) of G? Give either the corresponding rightmost derivation or tell why no such rightmost derivation exists.

- aAbB

- AbbB