

## Exercise Sheet 6

### Assignment 6.1 LR(1)-Parser

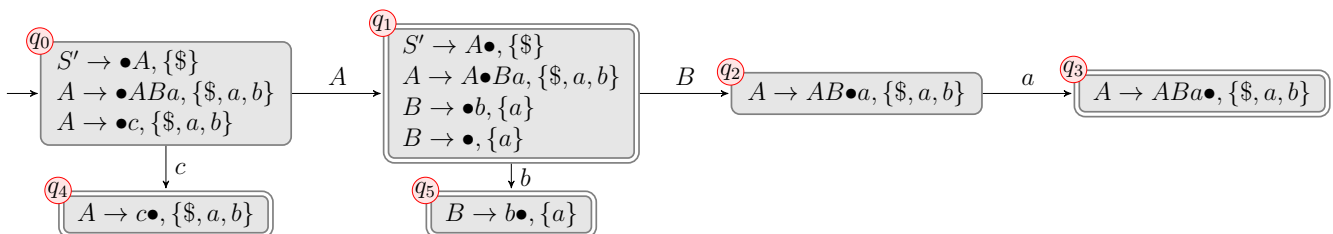
Consider the following grammar  $G$  with fresh start symbol  $S'$ :

$$\begin{aligned} S' &\rightarrow A^0 \\ A &\rightarrow ABa^0 \mid c^1 \\ B &\rightarrow b^0 \mid \epsilon^1 \end{aligned}$$

1. Draw the canonical LR(1)-automaton  $LR(G, 1)$ .
2. Give the action table.
3. Give all computation steps in order to parse an example word  $w$  produced by the grammar, i.e., give all intermediate steps  $(q_0, w) \vdash^* (f, \epsilon)$ .
4. Consider the grammar  $G$  together with the production  $A \rightarrow B$ . Is the resulting grammar LR(1)?

### Suggested Solution 6.1

1.



2.

	\$	a	b	c
$q_0$				$s$
$q_1$	$S', 0$	$B, 1$	$s$	
$q_2$		$s$		
$q_3$	$A, 0$	$A, 0$	$A, 0$	
$q_4$	$A, 1$	$A, 1$	$A, 1$	
$q_5$		$B, 0$		

3.

$$\begin{aligned} (q_0, cbaba\$) &\vdash (q_0q_4, baba\$) \vdash (q_0q_1, baba\$) \vdash (q_0q_1q_5, aba\$) \vdash (q_0q_1q_2, aba\$) \vdash (q_0q_1q_2q_3, ba\$) \\ &\vdash (q_0q_1, ba\$) \vdash (q_0q_1q_5, a\$) \vdash (q_0q_1q_2, a\$) \vdash (q_0q_1q_2q_3, \$) \\ &\vdash (q_0q_1, \$) \vdash (f, \$) \end{aligned}$$

4. In state  $q_0$  of the new grammar there exist multiple shift-reduce-conflicts  $[B \rightarrow \bullet b, y]$ ,  $[B \rightarrow \bullet, b]$  with  $y \in \{\epsilon, a, b\}$ . Therefore, the resulting grammar is not LR(1).

$q_0$

$S' \rightarrow \bullet A, \epsilon$
$A \rightarrow \bullet A B a, \{\epsilon, a, b\}$
$A \rightarrow \bullet c, \{\epsilon, a, b\}$
$A \rightarrow \bullet B, \{\epsilon, a, b\}$
$B \rightarrow \bullet b, \{\epsilon, a, b\}$
$B \rightarrow \bullet, \{\epsilon, a, b\}$