SChung42

HW 2: Grammars and Parsing

CS 421

Revision 1.0

Assigned Wednesday, March 16, 2016
Due Friday, April 1, 2016

Objectives

1. Demonstrate an ability to convert a grammar into an equivalent LL grammar.
2. Demonstrate an ability to produce an LR automata from a grammar.

LL Problems

(5 pts. each) For each of these grammars, convert it to an equivalent LL grammar or else assert that it is already LL.

1) $S \rightarrow x\,E \mid z$
$E \rightarrow E\,a\,E \mid E\,b\,E \mid c$

2) $S \rightarrow z\,y \mid y\,E$
$E \rightarrow S\,a \mid x\,a$

3) $S \rightarrow x\,E \mid x\,E\,y \mid z$
$E \rightarrow a\,E \mid b$

1. $S \rightarrow XE \mid z$
$E \rightarrow CE'$
$E' \rightarrow aEE' \mid bEE' \mid \varepsilon$

2. already LL

3. $S \rightarrow XES' \mid z$
$S' \rightarrow \varepsilon \mid y$
$E \rightarrow aE \mid b$

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LR Problem

Consider the following grammar:

$$
\begin{array}{llll}
1 & S \rightarrow & (SS) \\
2 & & \mid *V \\
3 & V \rightarrow & *V \\
4 & & \mid p
\end{array}
$$

(5 pts.) First, calculate the first and follow sets for the non-terminals of the grammar.

First(S) = $\{*, (\}$ Follow(S) = $\{(,), *, \$\}$

First(V) = $\{p, *\}$ Follow(V) = $\{(,), *, \$\}$

(30 pts.) Now, describe the LR automata for the grammar by listing the item sets (states) and filling out the action and goto tables.

Action

	p	*	(	)	$
0		S	S		
1		S	S		
2	S	S			
3		S	S		
4		R2	R2	R2	R2
5				S	
6		R1	R1	R1	R1
7	S	S			
8		R3	R3	R3	R3
9		R2	R2	R2	R2

Go To

	p	*	(	)	$	S	V
0		2	1				
1		2	1			3	
2	7	8					
3		2	1			6	
4							
5				6			
6							
7	8	4					9
8							
9							

0. $S \rightarrow \cdot(SS)$
   $\mid \cdot *V$
1. $S \rightarrow (\cdot SS)$
   $\mid \cdot (SS)$
   $\mid \cdot *V$
2. $S \rightarrow *\cdot V$
   $V \rightarrow \cdot *V$
   $\mid \cdot p$
3. $S \rightarrow (S \cdot S)$
   $\mid \cdot (SS)$
   $\mid \cdot *V$
4. $S \rightarrow *V \cdot$
5. $S \rightarrow (SS \cdot)$
6. $S \rightarrow (SS) \cdot$
7. $V \rightarrow *\cdot V$
   $\mid \cdot *V$
   $\mid \cdot p$
8. $V \rightarrow p \cdot$
9. $V \rightarrow *V \cdot$