

LL(1) parser

Ex.: Given the CFG $G = (\{S, A, B, C, D\}, \{+, *, a, (,)\}, P, S)$,

- $P :$
- (1) $S \rightarrow BA$
 - (2) $A \rightarrow +BA$
 - (3) $A \rightarrow \varepsilon$
 - (4) $B \rightarrow DC$
 - (5) $C \rightarrow *DC$
 - (6) $C \rightarrow \varepsilon$
 - (7) $D \rightarrow (S)$
 - (8) $D \rightarrow a,$

Parse the sequence $w = a * (a + a)$ using the LL(1) parser.

1) Compute FIRST 

	F_0	F_1	F2	F3
S	\emptyset	\emptyset	$(, a$	$(, a$
A	$+, \varepsilon$	$+, \varepsilon$	$+, \varepsilon$	$+, \varepsilon$
B	\emptyset	$(, a$	$(, a$	$(, a$
C	$*, \varepsilon$	$*, \varepsilon$	$*, \varepsilon$	$*, \varepsilon$
D	$(, a$	$(, a$	$(, a$	$(, a$

$\text{FIRST}(S) = \{ (, a \}$

$\text{FIRST}(A) = \{ +, \varepsilon \}$

$\text{FIRST}(B) = \{ (, a \}$

$\text{FIRST}(C) = \{ *, \varepsilon \}$

$\text{FIRST}(D) = \{ (, a \}$

2) Compute FOLLOW

//B: [REDACTED]

	L_0	L_1	L_2	L_3	L_4
S	ϵ	$\epsilon,)$	$\epsilon,)$	$\epsilon,)$	$\epsilon,)$
A	\emptyset	ϵ	$\epsilon,)$	$\epsilon,)$	$\epsilon,)$
B	\emptyset	$+, \epsilon$	$+, \epsilon,)$	$+, \epsilon,)$	$+, \epsilon,)$
C	\emptyset	\emptyset	$+, \epsilon$	$+, \epsilon,)$	$+, \epsilon,)$
D	\emptyset	$*$	$*, +, \epsilon$	$*, +, \epsilon,)$	$*, +, \epsilon,)$

$\text{FOLLOW}(S) = \{\epsilon,)\}$

$\text{FOLLOW}(A) = \{\epsilon,)\}$

$\text{FOLLOW}(B) = \{+, \epsilon,)\}$

$\text{FOLLOW}(C) = \{+, \epsilon,)\}$

$\text{FOLLOW}(D) = \{*, +, \epsilon,)\}$

3) Fill LL(1) parsing table

//B: [REDACTED]

	a	$+$	$*$	$($	$)$	$\$$
S	BA, 1			BA, 1		
A		+BA, 2			$\epsilon, 3$	$\epsilon, 3$
B	DC, 4			DC, 4		
C		$\epsilon, 6$	*DC, 5		$\epsilon, 6$	$\epsilon, 6$
D	a, 8			(S), 7		
a	pop					
$+$		pop				

*			pop			
(pop		
)					pop	
\$						acc

4) Parse the sequence //B: 

$(a * (a + a)\$, S\$, \epsilon) | -$
 $(a * (a + a)\$, BA\$, 1) | - (a * (a + a)\$, DCA\$, 14) | -$
 $(a * (a + a)\$, aCA\$, 148) | - (* (a + a)\$, CA\$, 148) | - (* (a + a)\$, * DCA\$, 1485) | -$
 $((a + a)\$, DCA\$, 1485) | - ((a + a)\$, (S)CA\$, 14857) | - (a + a)\$, S)CA\$, 14857) | -$
 $(a + a)\$, BA)CA\$, 148571) | - (a + a)\$, DCA)CA\$, 1485714) | -$
 $(a + a)\$, aCA)CA\$, 14857148) | - (+ a)\$, CA)CA\$, 14857148) | -$
 $(+ a)\$, A)CA\$, 148571486) | - (+ a)\$, + BA)CA\$, 1485714862) | -$
 $(a)\$, BA)CA\$, 1485714862) | - (a)\$, DCA)CA\$, 14857148624) | -$
 $(a)\$, aCA)CA\$, 148571486248) | - ()\$, CA)CA\$, 148571486248) | -$
 $()\$, A)CA\$, 1485714862486) | - ()\$,)CA\$, 14857148624863) | -$
 $(\$, CA\$, 14857148624863) | - (\$, A\$, 148571486248636) | -$
 $(\$, \$, 1485714862486363)$

LL(1) conflict

$A \rightarrow \alpha\beta$

$A \rightarrow \alpha\gamma$

transformed to

$A \rightarrow \alpha B$

$B \rightarrow \beta | \gamma$

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