LL(1) parser

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

//B: Iuliana Pascotescu

	F_0	F_1	F_2	$F_3 = F_2$ = FIRST
S	{}	{}	{(, a}	{(, a}
A	{+, ε}	{+, ε}	{+, ε}	{+, ε}
B	{}	{(, a}	{(, a}	{(, a}
C	{*, ε}	{*, ε}	{*, ε}	{*, ε}
D	{(, a}	{(, a}	{(,a}	{(, a}

FIRST(S) = {(, a}
FIRST(A) ={+, ε}
FIRST(B) ={(, a}
FIRST(C) ={*, ε}

FIRST(D) ={(, a}

2) Compute FOLLOW

Moca David

	L_0	L_1	L_2	L_3	L_4 = L_3 = FOLLOW
S	{ε}	{ε ,)}	{ε ,)}	{ε ,)}	{ε ,)}
A	{}	{ε}	{ε,)}	{ε,)}	{ε,)}
B	{}	{+, ε}	{+, ε,)}	{+, ε,)}	{+, ε,)}
C	{}	{}	{+, ε}	{+, ε,)}	{+, ε,)}
D	{}	{*}	{*,+, ε}	{*,+, ε,)}	{*,+, ε,)}

FOLLOW(S) = {ε ,)}
FOLLOW(A) ={ε,)}
FOLLOW(B) ={+, ε,)}
FOLLOW(C) ={+, ε,)}
FOLLOW(D) ={*,+, ε,)}

3) Fill LL(1) parsing table

//B: Iuliana Pascotescu

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

4) Parse the sequence

//B: Dragos P.

$(a*(a+a)\$, S\$, \varepsilon) \mid- (a*(a+a)\$, BA\$, 1) \mid-$

$(a*(a+a)\$, DCA\$, 1\,4) \vdash (a*(a+a)\$, aCA\$, 1\,4\,8) \mid-$

$(*(a+a)\$, CA\$, 1\,4\,8) \vdash (*(a+a)\$, *DCA\$, 1\,4\,8\,5) \vdash$

$((a+a)\$, DCA\$, 1\,4\,8\,5) \vdash ((a+a)\$, (S)CA\$, 1\,4\,8\,5\,7) \vdash$

(a + a)$, S)CA$, 1 4 8 5 7) |- (a + a)$, BA)CA$, 1 4 8 5 7 1) |-
(a + a)$, DCA)CA$, 1 4 8 5 7 1 4) |- (a + a)$, aCA)CA$, 1 4 8 5 7 1 4 8) |-
(+ a)$, CA)CA$, 1 4 8 5 7 1 4 8) |- (+ a)$, A)CA$, 1 4 8 5 7 1 4 8 6) |-
(+ a)$, + BA)CA$, 1 4 8 5 7 1 4 8 6 2) |- (a)$, BA)CA$, 1 4 8 5 7 1 4 8 6 2) |-

(a)$, DCA)CA$, 1 4 8 5 7 1 4 8 6 2 4) |-
(a)$, aCA)CA$, 1 4 8 5 7 1 4 8 6 2 4 8) | −
( )$, CA)CA$, 1 4 8 5 7 1 4 8 6 2 4 8) | −
( )$, A)CA$, 1 4 8 5 7 1 4 8 6 2 4 8 6) | −
( )$,)CA$, 1 4 8 5 7 1 4 8 6 2 4 8 6 3) | −
($, CA$, 1 4 8 5 7 1 4 8 6 2 4 8 6 3) | −
($, A$, 1 4 8 5 7 1 4 8 6 2 4 8 6 3 6) | −
($, $, 1 4 8 5 7 1 4 8 6 2 4 8 6 3 6 3) | −
acc