

The Exercises of The Chapter Five

5.1 Consider the following grammar:

$$E \rightarrow (L) \mid a$$

$$L \rightarrow L, E \mid E$$

a. Construct the DFA of LR(0) items for this grammar.

b. Construct the general SLR(1) parsing table.

c. Show the parsing stack and the actions of an SLR(1) parse for the input string ((a),a,(a,a))

d. Is this grammar an LR(0) grammar? If not, describe the LR(0) conflict, if so, construct the LR(0) parsing table, and describe how a parse might differ from an SLR(1) parse.

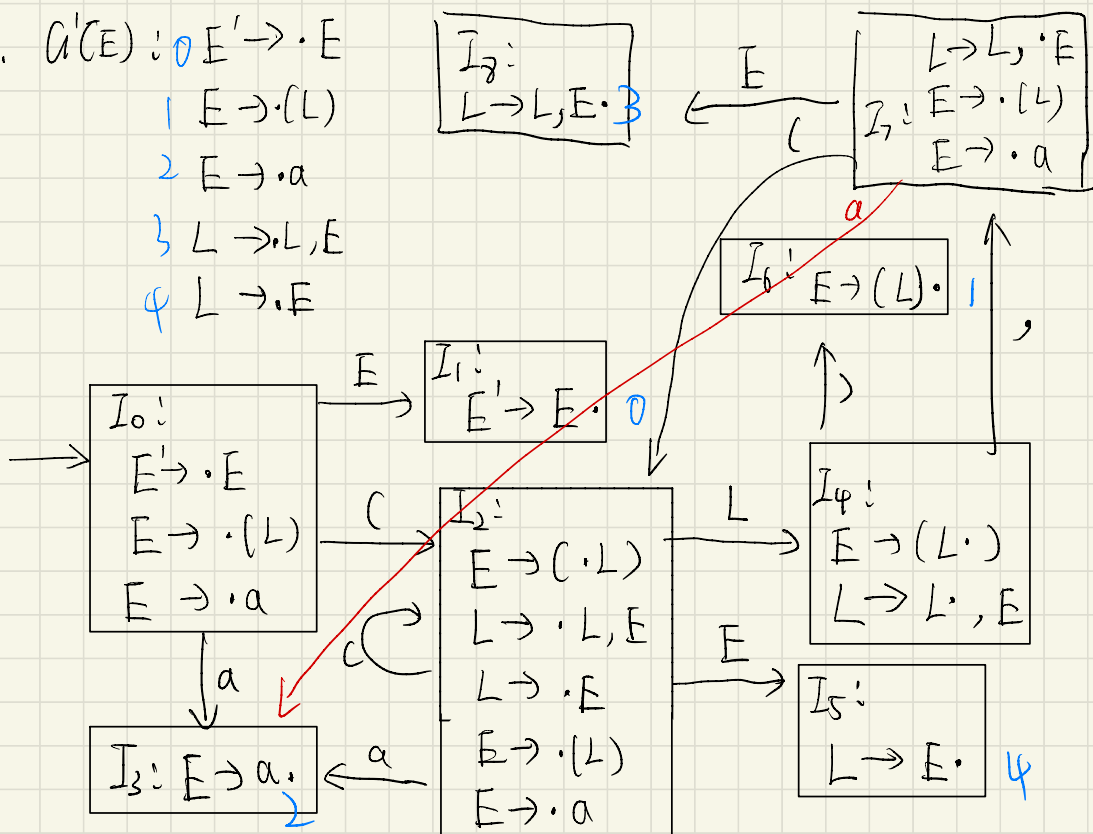
a. $G'(E) : 0 \ E' \rightarrow \cdot E$

1 $E \rightarrow \cdot (L)$

2 $E \rightarrow \cdot a$

3 $L \rightarrow \cdot L, E$

4 $L \rightarrow \cdot E$



b. $\text{First}(E') = \{ (, a \}$

$\text{Follow}(E') = \{ \# \}$

$\text{First}(E) = \{ (, a \}$

$\text{Follow}(E) = \{ , ,) , \# \}$

$\text{First}(L) = \{ (, a \}$

$\text{Follow}(L) = \{ , ,) \}$

I	Action					Goto	
	(	)	a	,	#	E	L
0	S ₂		S ₃			1	
1				ACCEPT			
2	S ₂		S ₃			5	4
3		R ₂		R ₂	R ₂		
4		S ₆		S ₇			
5		R ₄		R ₄			
6		R ₁		R ₁	R ₁		
7	S ₂		S ₃			8	
8		R ₃		R ₃			

C. SLR(1)

Step	Parsing stack	input	Action
1	\$ 0	((a), a, (a, a))\$	S ₂
2	\$ 0 (2	(a), a, (a, a))\$	S ₂
3	\$ 0 (2 (2	a), a, (a, a))\$	S ₃
4	\$ 0 (2 (2 a 3	), a, (a, a))\$	R ₂ : E → a
5	\$ 0 (2 (2 E 5	), a, (a, a))\$	R ₄ : L → E
6	\$ 0 (2 (2 L 4	) , a, (a, a))\$	S ₆
7	\$ 0 (2 (2 L 4) 6	, a, (a, a))\$	R ₁ : E → (L)
8	\$ 0 (2 E 5	, a, (a, a))\$	R ₄ : L → E
9	\$ 0 (2 L 4	, a, (a, a))\$	S ₇

10	\$ 0 C 2 L 4, 7	$\alpha, (\alpha, \alpha))$ \$	S3
11	\$ 0 C 2 L 4, 7 α 3	, (α, α)) \$	R2: $E \rightarrow \alpha$
12	\$ 0 C 2 <u>L 4, 7 E 8</u>	, (α, α)) \$	R3: $L \rightarrow L, E$
13	\$ 0 C 2 L 4	, (α, α)) \$	S7
14	\$ 0 C 2 L 4, 7	(α, α)) \$	S2
15	\$ 0 C 2 L 4, 7 (2	α, α)) \$	S3
16	\$ 0 C 2 L 4, 7 (2 α 3	, α)) \$	R2: $E \rightarrow \alpha$
17	\$ 0 C 2 L 4, 7 (2 E 5	, α)) \$	R4: $L \rightarrow E$
18	\$ 0 C 2 L 4, 7 (2 L 4	, α)) \$	S7
19	\$ 0 C 2 L 4, 7 (2 L 4, 7	α)) \$	S3
20	\$ 0 C 2 L 4, 7 (2 L 4, 7 α 3	) \$	R2: $E \rightarrow \alpha$
21	\$ 0 C 2 L 4, 7 (2 L 4, 7 E 8	) \$	R3: $L \rightarrow L, E$
22	\$ 0 C 2 L 4, 7 (2 L 4	) \$	S6
23	\$ 0 C 2 L 4, 7 (2 L 4) 6	) \$	R1: $E \rightarrow (L)$
24	\$ 0 C 2 L 4, 7 <u>E 8</u>	) \$	R3: $L \rightarrow L, E$
25	\$ 0 C 2 L 4	) \$	S6
26	\$ 0 C 2 L 4) 6	\$	R1: $E \rightarrow (L)$
27	\$ 0 E 1	\$	Accept

d It is a LR(0) grammar. It does not have a shift-reduce conflict or a Reduce-Reduce conflict.

I	Action					Goto	
	(	)	a	,	#	E	L
0	S ₂		S ₃			1	
1					Accept		
2	S ₂		S ₃			5	4
3	R ₂	R ₂	R ₂	R ₂	R ₂		
4		S ₆		S ₇			
5		R ₄		R ₄			
6	R ₁	R ₁	R ₁	R ₁	R ₁		
7	S ₂		S ₃			8	
8	R ₃	R ₃	R ₃	R ₃	R ₃		

SL(1) parse detects Errors faster.

5.2 Consider the following grammar:

$E \rightarrow (L) \mid a$

$L \rightarrow L, E$

- Construct the DFA of LR(1) items for this grammar.
- Construct the general LR(1) parsing table.
- Construct the DFA of LALR(1) items for this grammar.
- Construct the LALR(1) parsing table.
- Describe any difference that might occur between the actions of a general LR(1) parser and an LALR(1) parser.

a. $G'(E) : E' \rightarrow \cdot E$

1 $E \rightarrow \cdot (L)$

2 $E \rightarrow \cdot a$

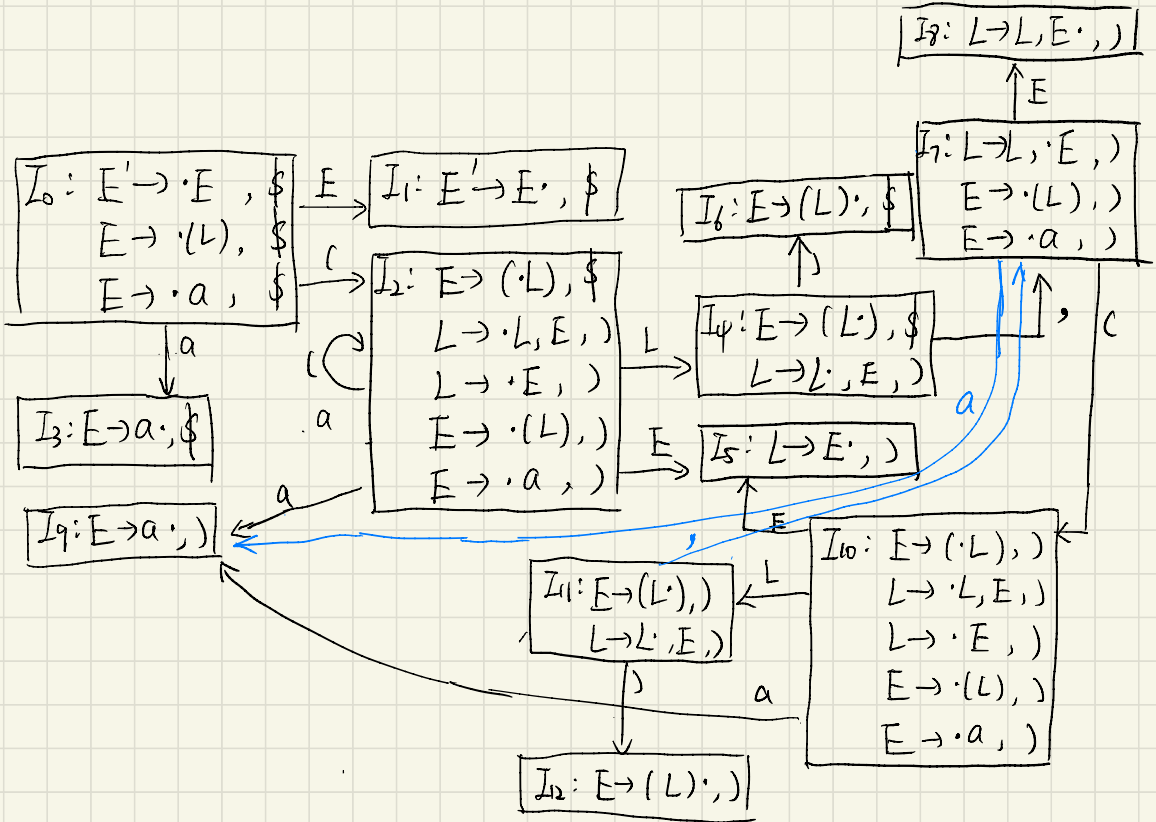
3 $L \rightarrow \cdot L, E$

4 $L \rightarrow \cdot E$

$\text{First}(E') = \{ (, a)$

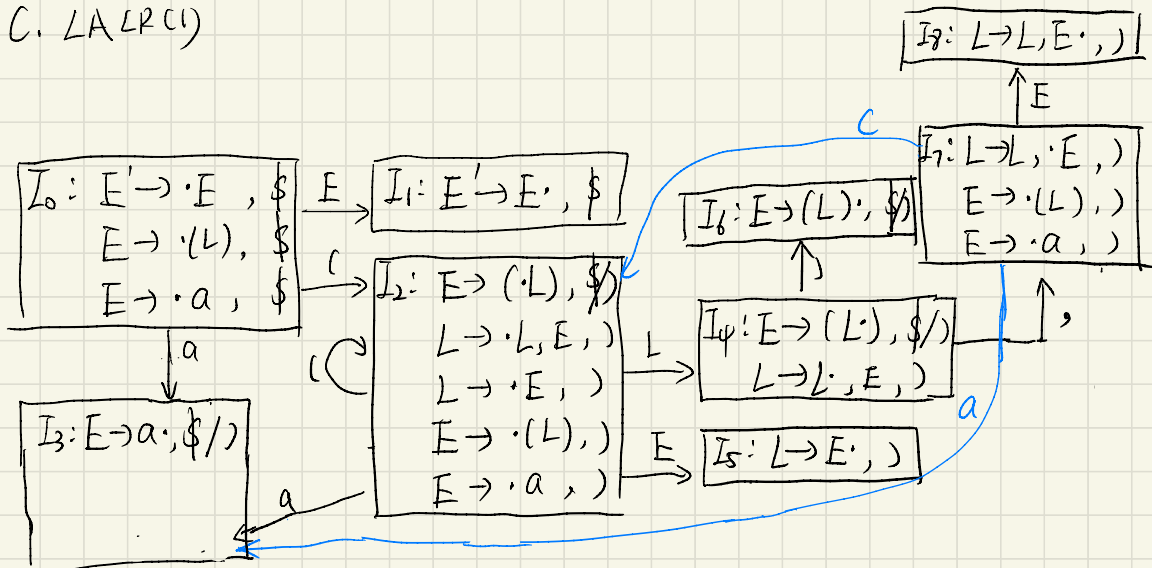
$\text{First}(E) = \{ (, a)$

$\text{First}(L) = \{ (, a)$



I	Action					Goto	
	(	)	a	,	\$	E	L
0	S ₂		S ₃			1	
1					Accept		
2	S ₂		S ₉			5	4
3		R₂		R₂	R ₂		
4		S ₆		S ₇			
5		R ₄		R₄			
6		R₁		R₁	R ₁		
7	S ₁₀		S ₉			8	
8		R ₃		R₃			
9		R ₂					
10						5	11
11		S ₂		S ₇			
12		R ₁					

c. LALR(1)



d.

I	Action					Goto	
	(	)	a	,	#	E	L
0	S ₂		S ₃			1	
1					Accept		
2	S ₂		S ₃			5	4
3		R ₂			R₂		
4		S ₆			S ₇		
5		R ₄			R₄		
6		R ₁			R₁	R ₁	
7	S ₂		S ₃			8	
8		R ₃			R₃		

e. LALR(1) may cause Reduce-Reduce conflicts