

3.6 a. Calculate nullable, FIRST, and FOLLOW for this grammar:

$S \rightarrow u B D z$
 $B \rightarrow B v$
 $B \rightarrow w$
 $D \rightarrow E F$
 $E \rightarrow y$
 $E \rightarrow$
 $F \rightarrow x$
 $F \rightarrow$

b. Construct the LL(1) parsing table.

c. Give evidence that this grammar is not LL(1).

d. Modify the grammar **as little as possible** to make an LL(1) grammar that accepts the same language.

a.

	nullable	first	follow
S	x	u	
B	x	w	v, x, y, z
D	✓	x, y	z
E	✓	y	x, z
F	✓	x	z

b.

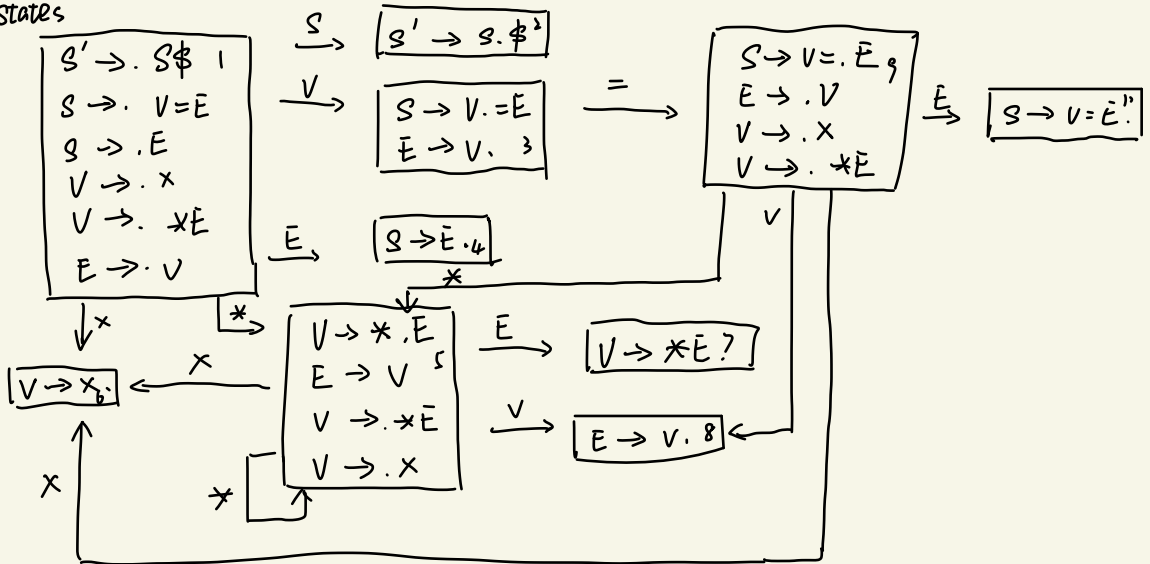
	u	z	v	w	x	y
S	$S \rightarrow u B D z$					
B				$B \rightarrow w$ $B \rightarrow B v$		
D		$D \rightarrow E F$			$D \rightarrow E F$	$D \rightarrow E F$
E		$E \rightarrow$			$E \rightarrow$	$E \rightarrow y$
F		$F \rightarrow$			$F \rightarrow x$	

c. $B \rightarrow B v$, $B \rightarrow w$ 存在左递归, 导致 parsing table 中, 同一项存在多条产生式, \therefore 不是 LL(1)

d. 其余不改变, 将 $B \rightarrow B v$ 改为 $B \rightarrow w B$
 $B \rightarrow w$

39 Diagram the LR(0) states for Grammar 3.26, build the SLR parsing table, and identify the conflicts.

States



CR(0)分析表

	x	$*$	$\$$	v	E	S
1	s_6	s_5		g_3	g_4	g_2
2			a			
3	$s_9 \Gamma_3$	Γ_3	Γ_3	Γ_3		
4	Γ_2	Γ_2	Γ_2	Γ_2		
5		s_6	s_5		g_8	g_7
6	Γ_4	Γ_4	Γ_4	Γ_4		
7	Γ_5	Γ_5	Γ_5	Γ_5		
8	Γ_3	Γ_3	Γ_3	Γ_3		
9		s_6	s_5		g_8	g_{10}
10	Γ_1	Γ_1	Γ_1	Γ_1		

状态3遇到 = 时存在移进归约冲突

SLR分析表

	=	X	*	\$	V	E	S
1		S ₆	S ₅		J ₃	J ₄	J ₂
2				a			
3	S ₉ Γ ₃			Γ ₃			
4				Γ ₂			
5		S ₆	S ₅		J ₈	J ₇	
6	Γ ₄			Γ ₄			
7	Γ ₅			Γ ₅			
8	Γ ₃			Γ ₃			
9		S ₆	S ₅		J ₈	J ₁₀	
10				Γ ₁			

	nullable	first	follow
S'	no	* x	
S	no	x x	\$
V	no	x. x	= \$
E	no	*. x	= \$

还是在状态3面对 = 时有在移进归约冲突!

Q. Is this an LR(1) grammar? Give evidence.

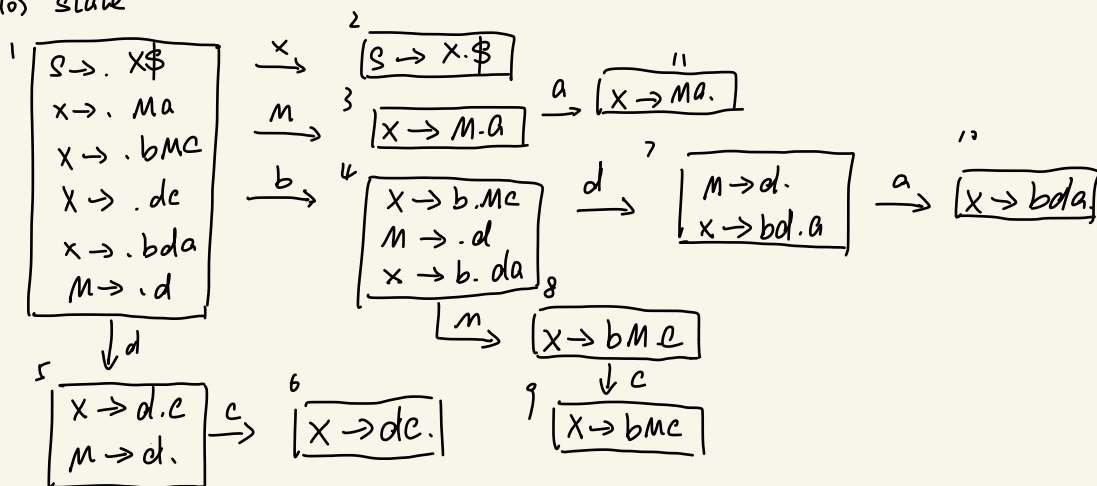
3/13 Show that this grammar is LALR(1) but not SLR:

- | | |
|-------------------------|-------------------------|
| 0 $S \rightarrow X \$$ | 3 $X \rightarrow d c$ |
| 1 $X \rightarrow M a$ | 4 $X \rightarrow b d a$ |
| 2 $X \rightarrow b M c$ | 5 $M \rightarrow d$ |

first follow

S		
x	bd	\$
M	d	a.c

2/10 state



SLR	a	b	c	d	\$	S	X	M
1		s ₄		s ₅			f ₂	f ₃
2				a				
3	s ₁₁							
4				s ₇				f ₈
5	r ₅		s ₆ r ₅					
6					r ₃			
7	r ₅ s ₁₀		r ₅					
8			s ₉					
9					r ₂			
10					r ₄			
11					r ₁			

SLR分析表存在移进-归约冲突 \therefore 不是 SLR 文法

Q. Is this an LR(1) grammar? Give evidence.

3/13 Show that this grammar is LALR(1) but not SLR:

0 $S \rightarrow X \$$

3 $X \rightarrow d c$

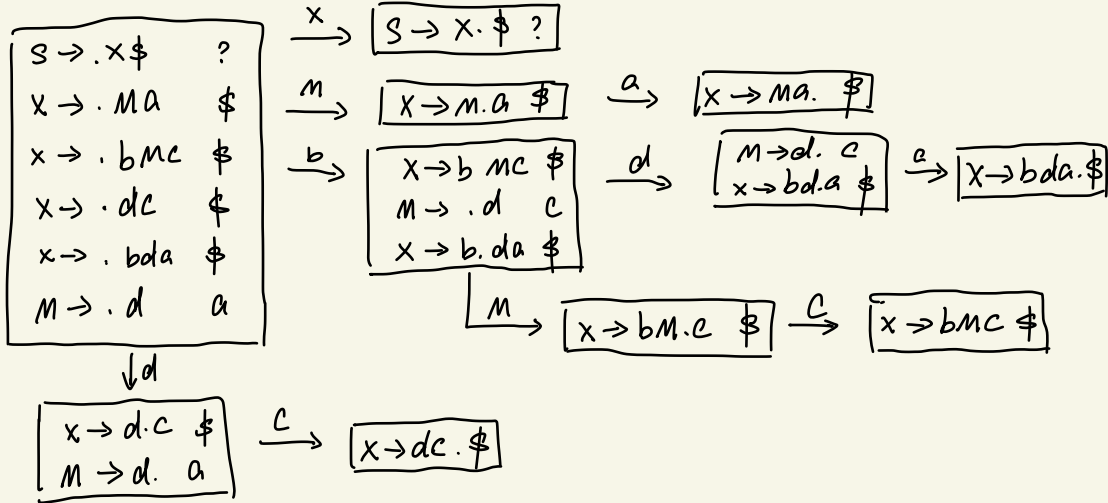
1 $X \rightarrow M a$

4 $X \rightarrow b d a$

2 $X \rightarrow b M c$

5 $M \rightarrow d$

LR(1) state



合并后 LALR(1) 分析表同 LR(1) 分析表. 不存在归约归约冲突.

\therefore 是 LALR(1) 文法

3.14 Show that this grammar is LL(1) but not LALR(1):

- | | |
|-----------------------|-----------------------|
| 1 $S \rightarrow (X$ | 5 $X \rightarrow F]$ |
| 2 $S \rightarrow E]$ | 6 $E \rightarrow A$ |
| 3 $S \rightarrow F)$ | 7 $F \rightarrow A$ |
| 4 $X \rightarrow E)$ | 8 $A \rightarrow$ |

	nullable	first	follow
S	x	(.) .]	
X	x) .]	
E	✓) .]
F	✓) .]
A	V) .]

LL(1) 分析表

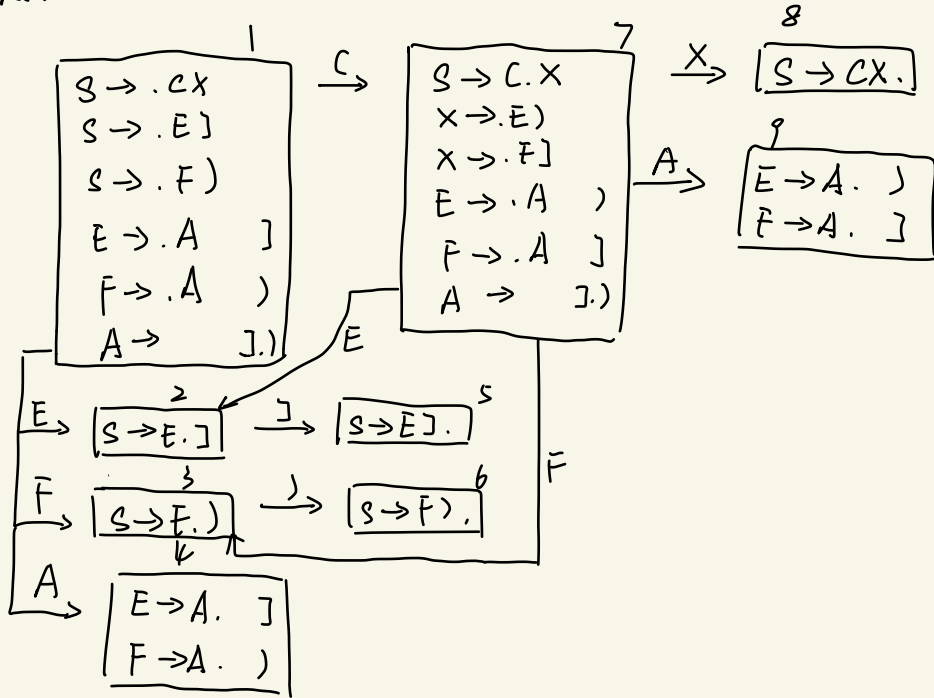
	()]
S	$S \rightarrow (X$	$S \rightarrow F)$	$S \rightarrow E]$
X		$X \rightarrow E)$	$X \rightarrow F]$
E		$E \rightarrow A$	$E \rightarrow A$
F		$F \rightarrow A$	$F \rightarrow A$
A		$A \rightarrow$	$A \rightarrow$

不存在冲突, 所以为 LL(1) 文法

3.14 Show that this grammar is LL(1) but not LALR(1):

- | | |
|-----------------------|-----------------------|
| 1 $S \rightarrow (X$ | 5 $X \rightarrow F]$ |
| 2 $S \rightarrow E]$ | 6 $E \rightarrow A$ |
| 3 $S \rightarrow F)$ | 7 $F \rightarrow A$ |
| 4 $X \rightarrow E)$ | 8 $A \rightarrow$ |

LALR(1) State



在 LALR state 中, 状态 4 与状态 9 可以合并. 得

$E \rightarrow A \cdot])$
$F \rightarrow A \cdot))$

存在归约归约冲突

\therefore 不是 LALR(1) 文法