编译原理第3次作业：

4.3.1

(a) 无左公因子.

(b) 不能，文法中存在左递归，会无限循环.

(c) rexpr → return rexpr'

rexpr' → + rterm rexpr' | ε.

rterm → rfactor rterm'

rterm' → rfactor rterm' | ε.

rfactor → rprimary rfactor'

rfactor' → * rfactor' | ε.

rprimary → a | b.

(d) 适用.

4.6.5

$$\begin{bmatrix} S \to AaAb \mid BbBa \\ A \to \varepsilon. \\ B \to \varepsilon. \end{bmatrix}$$

(1) first(AaAb) = (first(A) - ε) ∨ first(aAb) = {a}.

first(BbBa) = (first(B) - ε) ∨ first(bBa) = {b}.

first(AaAb) ∧ first(BbBa) = ∅

故是 LL(1) 文法.

(2) $S' \to S$

$S \to AaAb$

$S \to BbBa$.

$A \to \varepsilon$

$B \to \varepsilon$.

I_0:

$S' \to \cdot S$

$S \to \cdot AaAb$

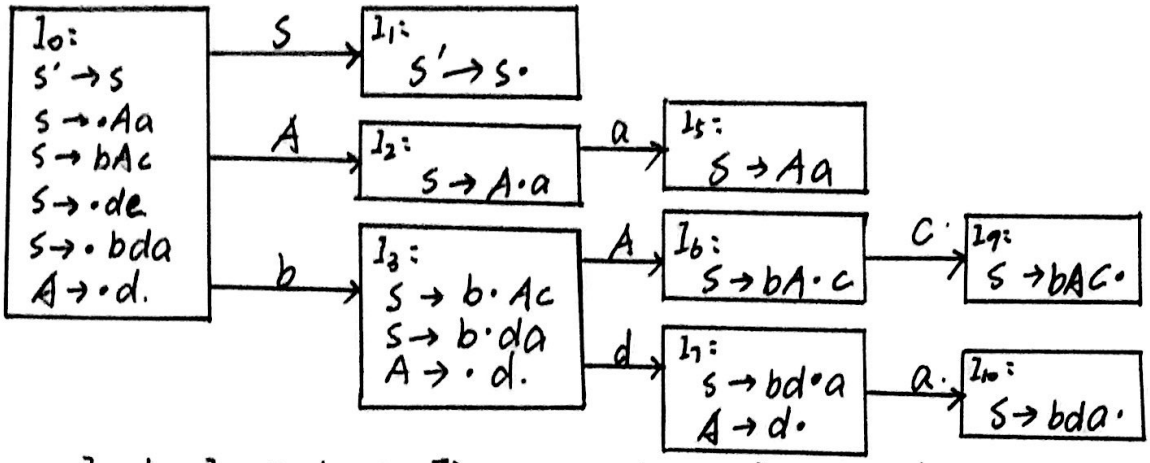
$S \to \cdot BbBa$

$A \to \cdot$

$B \to \cdot$

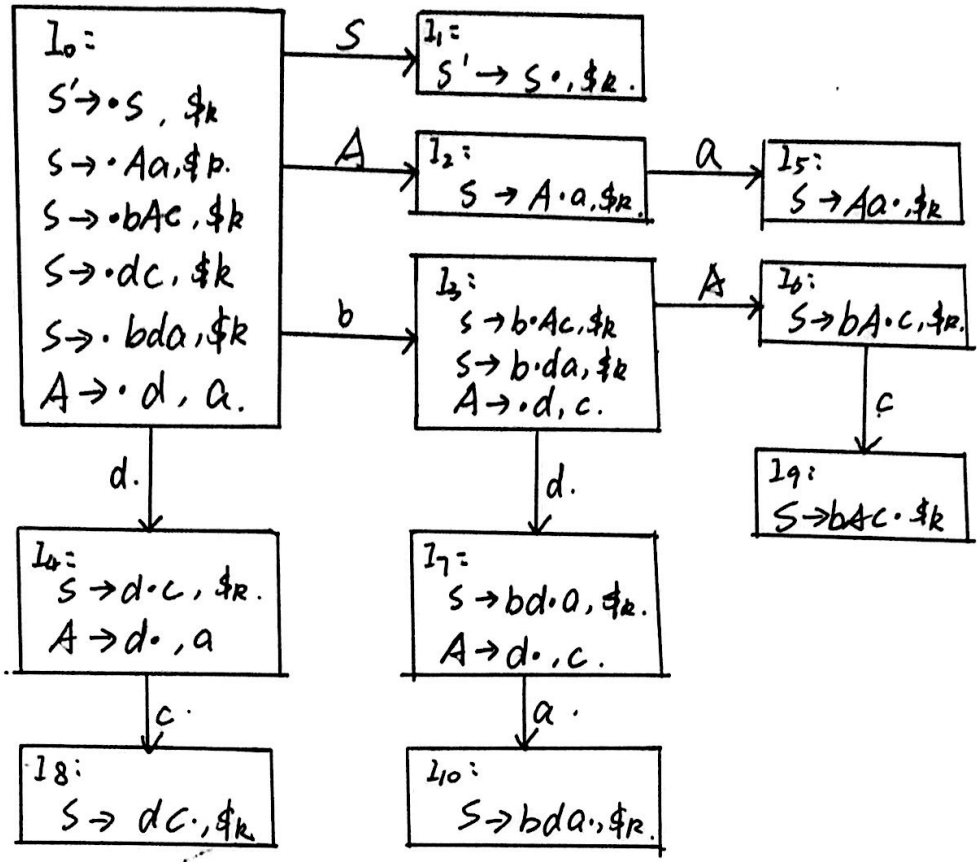
follow(A) ∧ follow(B) ≠ ∅

产生了归约-归约冲突，故不是 SLR(1).



I_4 与 I_7 均存在移进-归约冲突，故非 SLR(1)

(2)



States	Action				Go To.		
	a	b	c	d	$k	S	A
0		S_3		S_4		1	2
1					acc		
2	S_5						
3				S_1			6
4	r_5		S_8				
5					r_1		
6			S_9				
7	S_{10}		r_5				
8					r_3		
9					r_2		
10					r_4		

满足 LR(1)
且无同心项，
满足 LALR(1)

4.6.6.

$$\begin{bmatrix} S \to SA \mid A \\ A \to a \end{bmatrix}$$

(1) first(SA) = {a}.

first(A) = {a}.

first(SA) ∩ first(A) ≠ ∅.

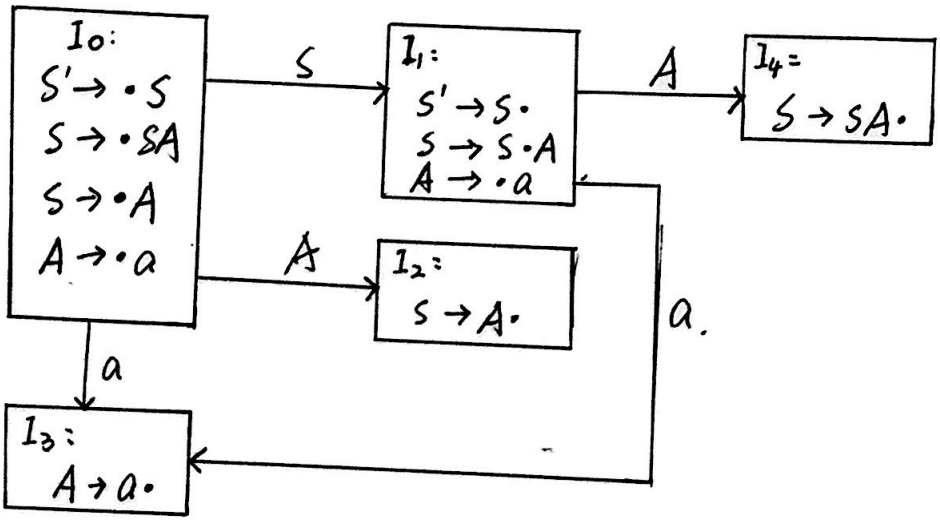
故非 LL(1)文法.

(2) $S' \to S$

$S \to SA$

$S \to A$

$A \to a$



States	Action		GoTo	
	a	$\$_k$	S	A
0	S_3		1	2
1	S_3	acc		4
2	r_2	r_2		
3	r_3	r_3		
4	r_1	r_1		

不存在冲突，故为 SLR(1).

4.7.4

$$\begin{bmatrix} S \to Aa \mid bAc \mid dc \mid bda \\ A \to d \end{bmatrix}$$

(1) $S' \to S$

$S \to Aa$

$S \to bAc$

$S \to dc$

$S \to bda$

$A \to d$.

4.7.5

S'→ S (0)

S→ Aa (1)

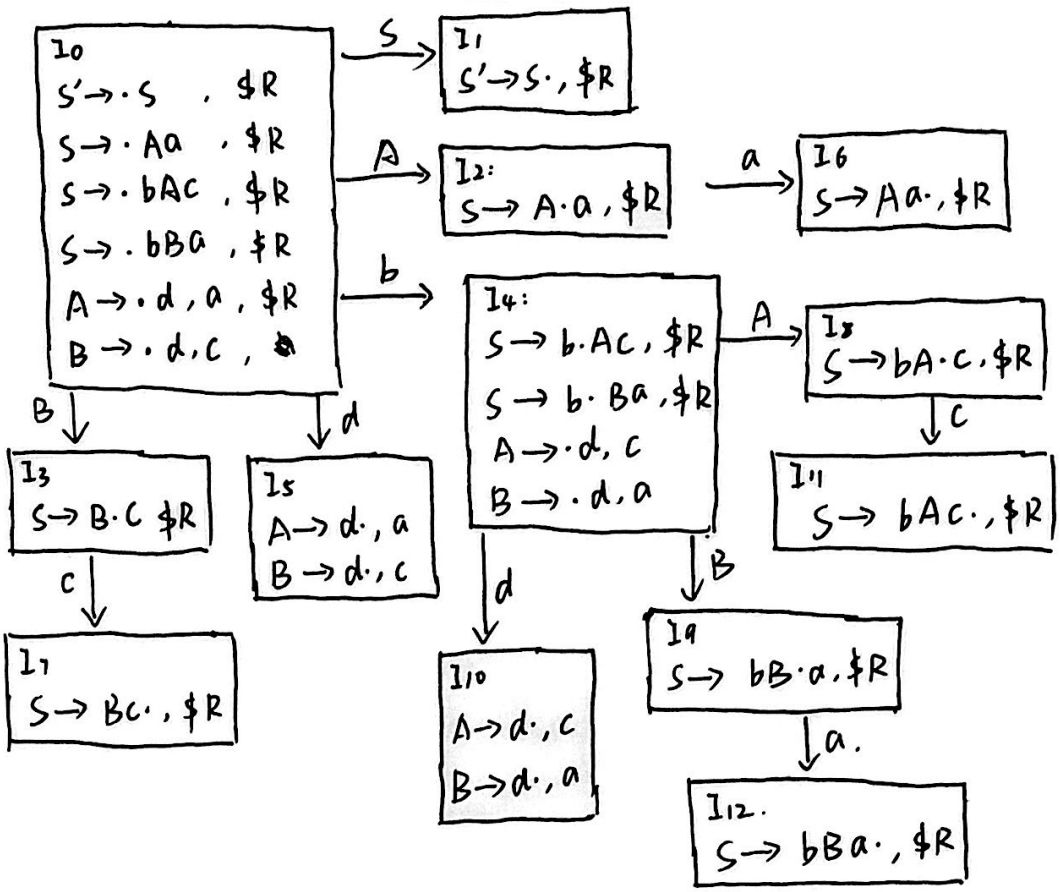
S→ bAc (2)

S→ Bc (3)

S→ bBa (4)

A→ d (5)

B→ d (6)



States	Action					Goto		
	a	b	c	d	$R	S	A	B
0		S4		S5		1	2	3
1								
2	S6							
3			S7					
4							8	9
5	r5		r6					
6								
7								
8			S11					
9	S12							
10	r6		r5					
11					r2			
12					r4.			

dbq. 图画太丑了.

无冲突，显然是LR(1)文法.

然而，若合并同心态 I_5, I_{10}，则

新状态为 A→d·, a|c

B→d·, a|c

有归约一归约的冲突，故非LALR文法.

4.8.1

(a)

$E' \to E$

$E \to E\theta_1 E$

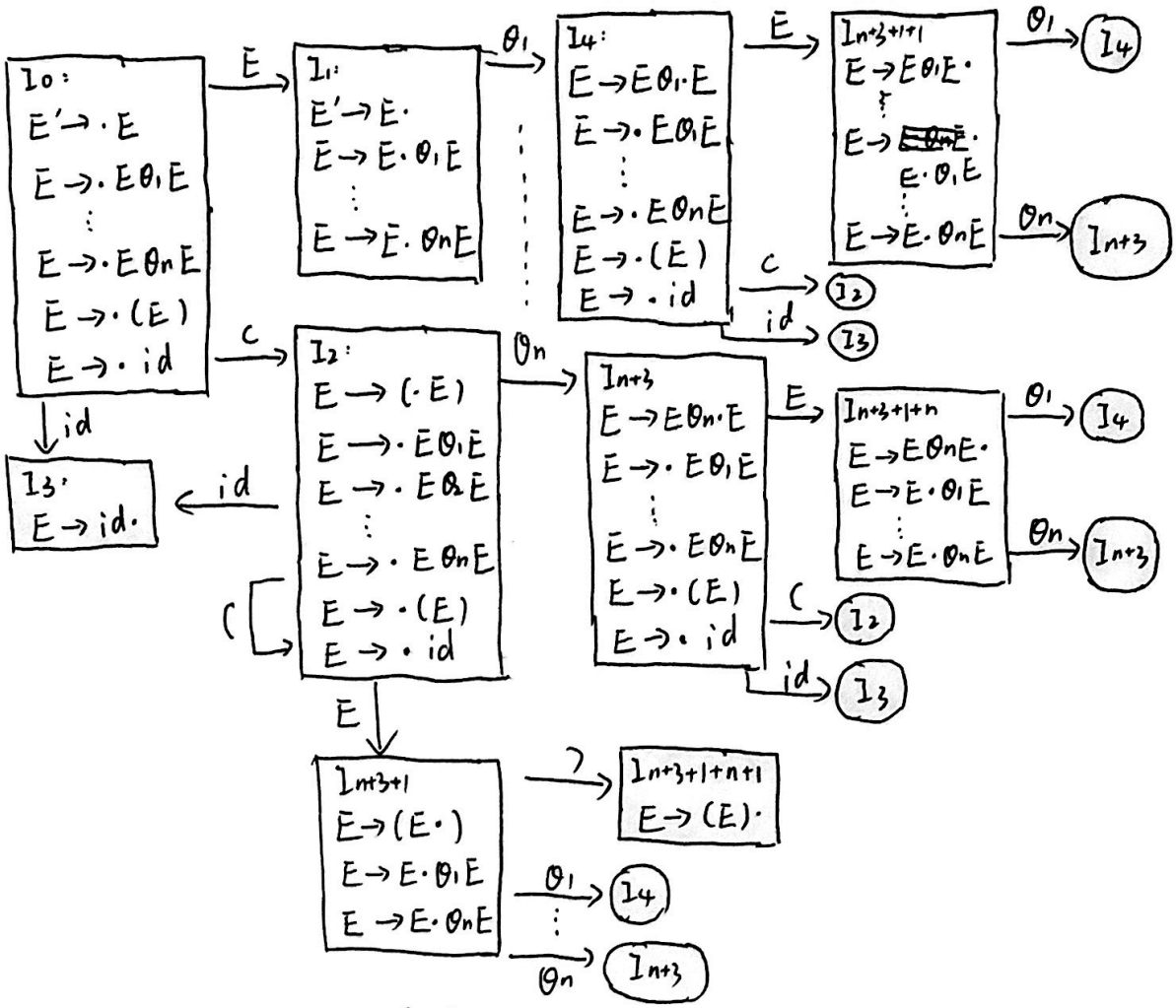
$E \to E\theta_2 E$

$\vdots$

$E \to E\theta_n E$

$E \to (E)$

$E \to id$



从 $I_0 \to I_{2n+5}$，共有 $2n+6$ 个

(b) 当发生冲突，则根据终结符的优先级进行移进/归约处理。

（优先级设计符合题意即可）

CH-4 exercises

1. ① 消除左递归：

$S \to iCtS \mid iCtSeS \mid a$

$C \to DC'$

$C' \to orDC' \mid \varepsilon$

$D \to ED'$

$D' \to orED' \mid \varepsilon$

$E \to (c) \mid b$

② 提取最大左公因子

$S \to iCtSS' \mid a$

$S' \to es \mid \varepsilon$

$C \to DC'$

$C' \to orDC' \mid \varepsilon$

$D \to ED'$

$D' \to orED' \mid \varepsilon$

$E \to (c) \mid b$

③ 构造LL(1)分析表

first(S) = {i, a}

first(S') = {e, ε}

first(C) = first(D) = first(E) = {c, b}

first(C') = {or, ε}

first(D') = {or, ε}

follow(S) = follow(S') = {$R, e}.

follow(c) = {t,)}

follow(C') = follow(C) = {t,)}

follow(D) = first(C') ∪ follow(C') ∪ follow(C). = {or} ∪ {t,)} = {or, t,)}

follow(D') = follow(D) = {or, t,)}

follow(E) = ~~follow~~ first(D') ∪ follow(D) ∪ follow(D').

= {or} ∪ {or, t,)} = {or, t,)}

LL(1) 分析表

	i	t	a	e	or	(	)	b	$R
S	S→iCtSS'		S→a						
S'				S→eS S'→ε					S'→ε
C						C→DC'		C→bC'	
D						D→ED'		D→ED'	
C'		C'→ε			C'→orDC'		C'→ε		
D'		D'→ε			D'→orED' D'→ε			D'→ε	
E						E→(C)		E→b	

表中有两个冲突项，故不是LL(1)文法。

2.

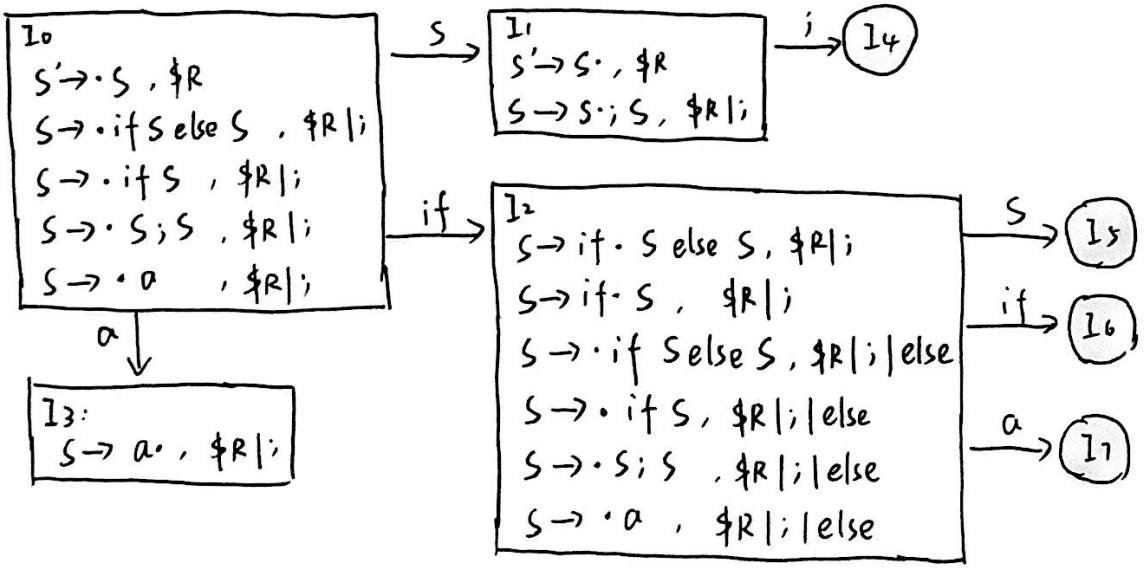
S'→S (0)

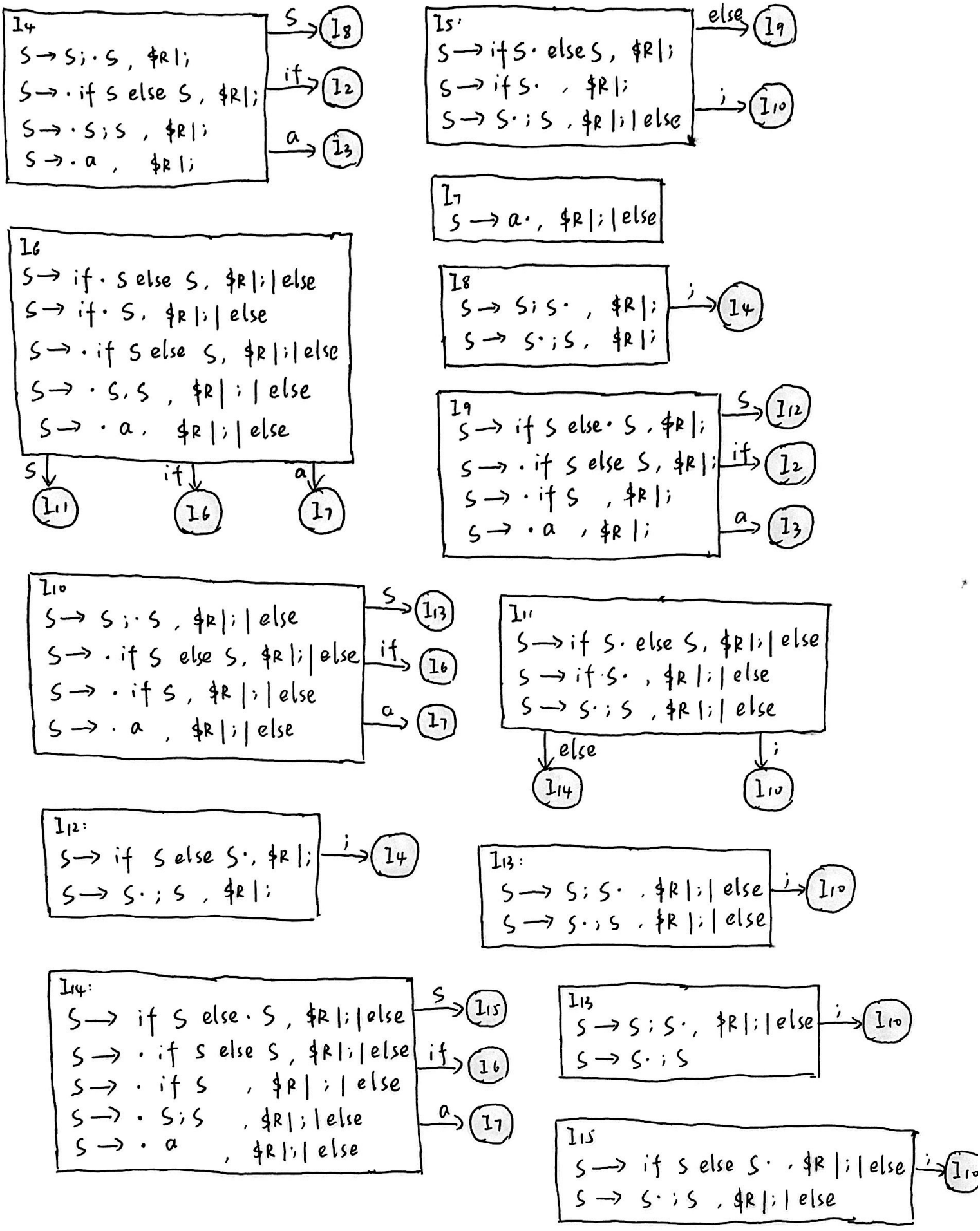
S→ if S else S (1)

S→ if S (2)

S→ S;S (3)

S→ a (4)




I4
S → S ; · S , $R|;
S → · if S else S , $R|;
S → · S ; S , $R|;
S → · a , $R|;
S
if
a
I8
I2
I3
I5:
S → if S · else S , $R|;
S → if S · , $R|;
S → S · ; S , $R|; | else
else
;
I9
I10
I7
S → a · , $R|; | else
I6
S → if · S else S , $R|; | else
S → if · S , $R|; | else
S → · if S else S , $R|; | else
S → · S ; S , $R|; | else
S → · a , $R|; | else
S
if
a
I11
I16
I17
I8
S → S ; S · , $R|;
S → S · ; S , $R|;
;
I14
I9
S → if S else · S , $R|;
S → · if S else S , $R|;
S → · if S , $R|;
S → · a , $R|;
S
if
a
I12
I2
I3
I10
S → S ; · S , $R|; | else
S → · if S else S , $R|; | else
S → · if S , $R|; | else
S → · a , $R|; | else
S
if
a
I13
I16
I17
I11
S → if S · else S , $R|; | else
S → if S · , $R|; | else
S → S · ; S , $R|; | else
else
;
I14
I10
I12:
S → if S else S · , $R|;
S → S · ; S , $R|;
;
I14
I13:
S → S ; S · , $R|; | else
S → S · ; S , $R|; | else
;
I10
I14:
S → if S else · S , $R|; | else
S → · if S else S , $R|; | else
S → · if S , $R|; | else
S → · S ; S , $R|; | else
S → · a , $R|; | else
S
if
a
I15
I16
I17
I13
S → S ; S · , $R|; | else
S → S · ; S
;
I10
I15
S → if S else S · , $R|; | else
S → S · ; S , $R|; | else
;
I10

States	Action				$R	Goto
	if	else	i	a		S
0	S_2			S_3		1
1			S_4		acc	
2	S_6			S_7		5
3			r_4		r_4	
4	S_2			S_3		8
5		S_9	S_{10} r_2		r_2	
6	S_6			S_7		11
7		r_4	r_4		r_4	
8			S_4 r_3		r_3	
9	S_2			S_3		12
10	S_6			S_7		13
11		S_{14} r_2	S_{10} r_2		r_2	
12			S_4 r_1		r_1	
13		r_3	S_{10} r_3		r_3	
14				S_7		15
15		r_1	S_{10} r_1		r_1	

$\boxed{S_{10}\ r_2}$: 附加条件 1°, 故 r_2

$\boxed{S_4\ r_3}$: 附加条件 2°, 故 r_3

$\boxed{S_{14}\ r_2}$: 附加条件 3°, 故 S_{14}

$\boxed{S_{10}\ r_2}$: 附加条件 1°, 故 r_2

$\boxed{S_4\ r_1}$: 附加条件 1°, 故 r_1

$\boxed{S_{10}\ r_3}$: 条件 2°, 故 r_3

$\boxed{S_{10}\ r_1}$: 条件 1°, 故 r_1

附加条件 (参考)

1° if, else 优先级高于;

2° ; 左结合

3° else 与最近的未匹配的 if 匹配.