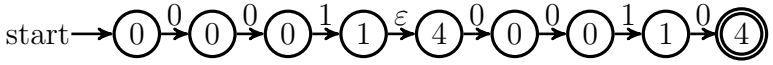
武汉大学计算机学院2014-2015学年第一学期
2012级《编译原理》参考答案

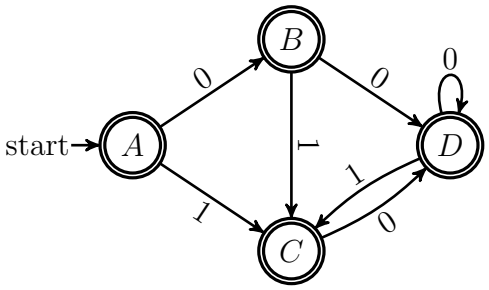
一、 (1)



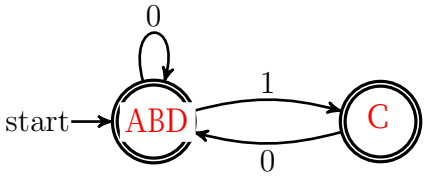
(2)

$$A = \{0, 3\},\ B = \{0, 1, 3, 4, 5\},\ C = \{1\},\ D = \{0, 1, 2, 3, 4, 5\}.$$

状态转换图为：



(3) 最小DFA如下所示：



(4) 由0和1组成的串，且没有连续的1.

(5) $r = (1 \mid \varepsilon)(0 \mid 01)^*$.

二、 (1) 最左推导如下：

$$\begin{aligned}
E &\underset{lm}{\Longrightarrow} L \\
&\underset{lm}{\Longrightarrow} (S) \\
&\underset{lm}{\Longrightarrow} (S\ S) \\
&\underset{lm}{\Longrightarrow} (E\ S) \\
&\underset{lm}{\Longrightarrow} (a\ S) \\
&\underset{lm}{\Longrightarrow} (a\ E) \\
&\underset{lm}{\Longrightarrow} (a\ L) \\
&\underset{lm}{\Longrightarrow} (a\ (S)) \\
&\underset{lm}{\Longrightarrow} (a\ (S\ S)) \\
&\underset{lm}{\Longrightarrow} (a\ (E\ S)) \\
&\underset{lm}{\Longrightarrow} (a\ (a\ S)) \\
&\underset{lm}{\Longrightarrow} (a\ (a\ E)) \\
&\underset{lm}{\Longrightarrow} (a\ (a\ a))
\end{aligned}$$

(2) 消除左递归后的文法如下：

$$\begin{aligned} E &\rightarrow L \mid a \\ L &\rightarrow (S) \\ S &\rightarrow E\,S' \\ S' &\rightarrow S\,S' \mid \varepsilon \end{aligned}$$

(3) $\mathrm{First}(E) = \mathrm{First}(S) = \{\, a, (\,\}$; $\mathrm{First}(L) = \{\, (\,\}$; $\mathrm{First}(S') = \{\, a, (, \varepsilon \,\}$.
$\mathrm{Follow}(E) = \mathrm{Follow}(L) = \{\, a, (,), \$ \,\}$; $\mathrm{Follow}(S) = \mathrm{Follow}(S') = \{\, a, (,) \,\}$.

(4) LL(1)分析表如下所示：

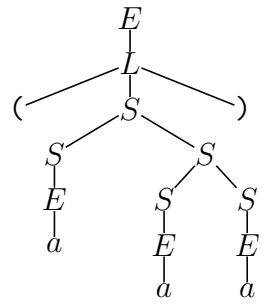
	a	(	)	$
E	$E \rightarrow a$	$E \rightarrow L$		
L		$L \rightarrow (S)$		
S	$S \rightarrow ES'$	$S \rightarrow ES'$		
S'	$S' \rightarrow SS' \mid \varepsilon$	$S' \rightarrow SS' \mid \varepsilon$	$S' \rightarrow \varepsilon$	

(5) 语句“(aa)”的分析过程如下所示：

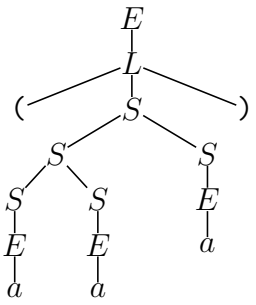
剩余串	分析栈	分析动作
$(aa)\$$	$E\$$	$E \rightarrow L$
$(aa)\$$	$L\$$	$L \rightarrow (S)$
$(aa)\$$	$(S)\$$	match-advance
$aa)\$$	$S)\$$	$S \rightarrow ES'$
$aa)\$$	$ES')\$$	$E \rightarrow a$
$aa)\$$	$aS')\$$	match-advance
$a)\$$	$S')\$$	$S' \rightarrow SS'$
$a)\$$	$ES'S')\$$	$S \rightarrow ES'$
$a)\$$	$ES'S')\$$	$E \rightarrow aS'$
$)\$$	$S'S')\$$	$S' \rightarrow \varepsilon$
$)\$$	$S')\$$	$S' \rightarrow \varepsilon$
$)\$$	$)\$$	match-advance
$\$$	$\$$	分析成功

三、 (1) 语句“(aaa)”的两颗不同的语法树为：

语法树1：



语法树2：



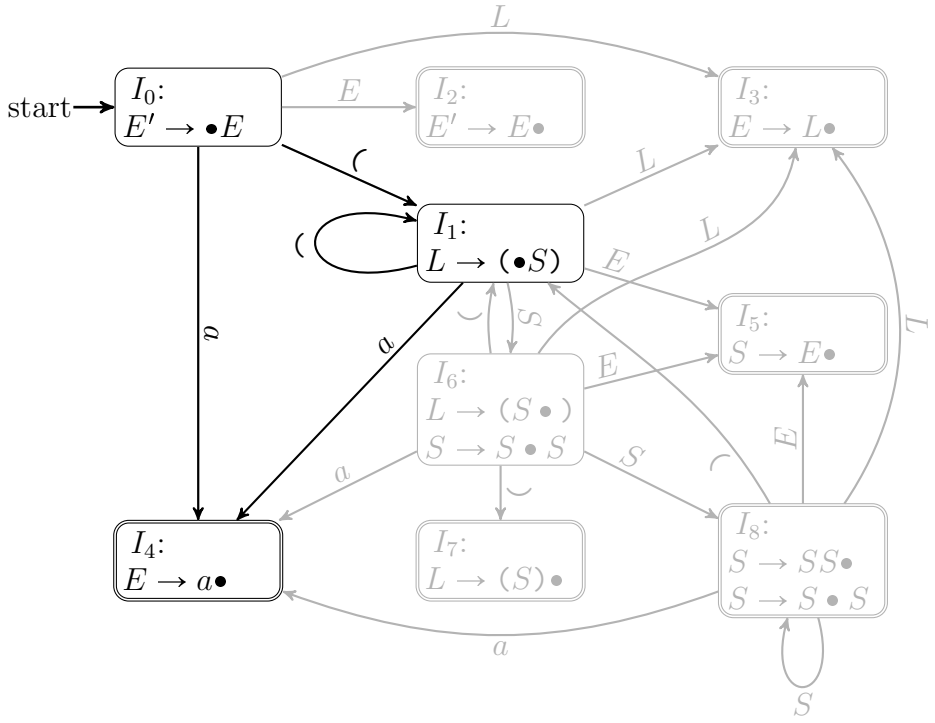
(2) 无二义文法：

$$\begin{aligned} E &\to L \mid a \\ L &\to (S) \\ S &\to E\ S \mid E \end{aligned}$$

四、 (1) 状态I_1的LR(0)项目集为

$$\begin{aligned} &\overline{\{\, L \to (\bullet S) \,\}} \\ =\ &\{L \to (\bullet S), S \to \bullet S\, S, S \to \bullet E, E \to \bullet L, \\ &E \to \bullet a, L \to \bullet (S)\} \end{aligned}$$

(2) 识别活前缀的自动机在消除了接受非终结符的状态和转换边后如下所示：



将剩余的状态转换图的每个状态都看成接受状态所得到的自动机即是识别所有以终结符组成的活前缀自动机，其对应的正则式为：$(^*(a \mid \varepsilon)$.

(3) $\mathrm{First}(E) = \mathrm{First}(S) = \{\, a, (\,\}$，$\mathrm{First}(L) = \{\, (\,\}$；
$\mathrm{Follow}(E) = \mathrm{Follow}(L) = \{\, a, (,), \$ \,\}$，$\mathrm{Follow}(S) = \{\, a, (,) \,\}$
SLR分析表如下所示：

	action				goto		
状态	a	(	)	\$	E	L	S
0	s4	s1			2	3	
1	s4	s1			5	3	6
2				acc			
3	r1	r1	r1	r1			
4	r2	r2	r2	r2			
5	r5	r5	r5				
6	s4	s1	s7		5	3	8
7	r3	r3	r3	r3			
8	**s4**	**s1**	r4		5	3	8

(4) 语句“(aa)”的分析过程如下所示：

剩余串	分析栈	分析动作
$(aa)\$$	0	shift
$aa)\$$	$0(1$	shift
$a)\$$	$0(1a4$	reduce $E \to a$
$a)\$$	$0(1E5$	reduce $S \to E$
$a)\$$	$0(1S6$	shift
$)\$$	$0(1S6a4$	reduce $E \to a$
$)\$$	$0(1S6E5$	reduce $S \to E$
$)\$$	$0(1S6S8$	reduce $S \to SS$
$)\$$	$0(1S6$	shift
\$	$0(1S6)7$	reduce $L \to (S)$
\$	$0L3$	reduce $E \to L$
\$	$0E2$	分析成功

五、 (1)

产生式	语义规则
$E' \to E$	E.is_head = True
$E \to a$	E.exp = a.lexval E.count = 1
$E \to L$	L.is_head = E.is_head E.exp = L.exp E.count = L.count

$L \to (S)$	S.is_head = True
	if (S.count > 1)
	  L.exp = S.exp + ")"
	else
	  L.exp = S.exp
	L.count = S.count

$S \rightarrow S_1\, S_2$	S_1.is_head = S.is_head
	S_2.is_head = S.False
	if (S.is_head $\wedge$ S_1.count == 1)
	  S.exp = S_1.exp + "(" + S_2.expr
	if (S.is_head $\wedge$ S_1.count > 1)
	  S.exp = "(" + S_1.exp + ")(" + S_2.expr
	if (S.is_head == False)
	  S.exp = S_1.exp + "," + S_2.expr
	S.count = S_1.count + S_2.count

$S \rightarrow E$	E.is_head = S.is_head
	if (E.is_head $\wedge$ E.count > 1)
	  S.exp = "(" + E.exp + ")"
	  S.count = 1
	else
	  S.count = E.count
	  S.exp = E.exp

(2) `(a(b(c)))(d,e(f,g(h)))`.

六、

```
L1: t0 := x + 1              | L0: t1 := x + 2
    x := t0                  |     x := t1
    ifnot (e > f) goto L0    |     ifnot (a > b) goto L2
    ifnot (g > h) goto L2    |     ifnot (c > d) goto L1
    ifnot (i > k) goto L2    | L2:
```

七、the Intel x86 processor represents a common little-endian architecture, and function call of GCC will put actual arguments in reverse order, so the output is 20152014.