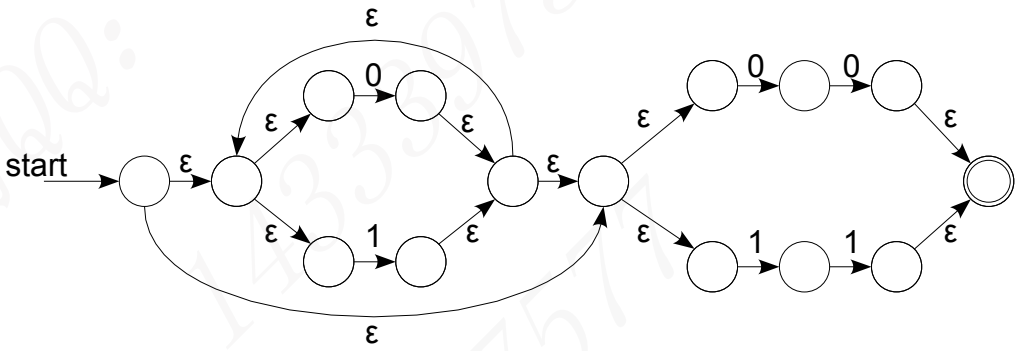
武汉大学计算机学院2006-2007学年第二学期

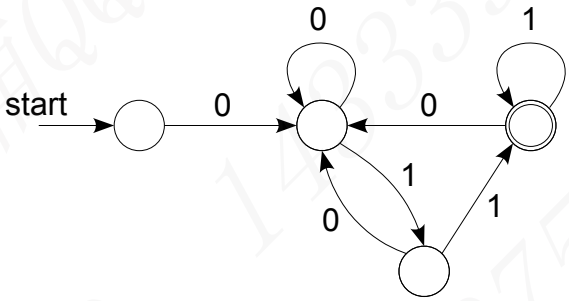
2004级《编译原理》参考答案

一、 (1) $0(0|1)*11$

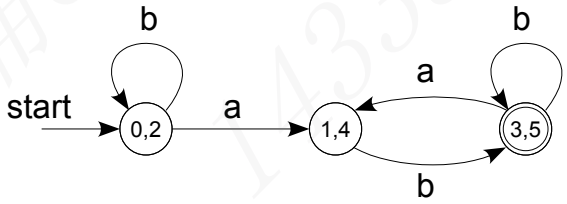
(2)



(3)



(4)

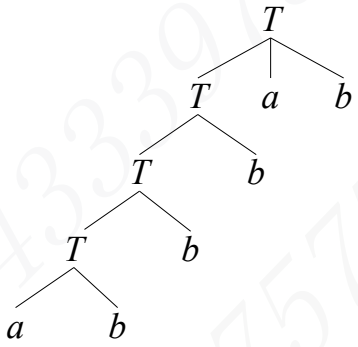


二、 (1) $S \rightarrow aSbb \mid abb$;

(2) 由a和b组成的非空字符串且a之后一定是b; 或正规表达式$(ab|b)^+$所生成的语言;

(3)

$$
\begin{aligned}
T &\underset{lm}{\Longrightarrow} Tab \\
&\underset{lm}{\Longrightarrow} Tbab \\
&\underset{lm}{\Longrightarrow} Tbbab \\
&\underset{lm}{\Longrightarrow} abbbab
\end{aligned}
$$



三、 (1) $\text{First}(S) = \{\, a, c, d \,\}$;
$\text{First}(A) = \{\, a \,\}$;
$\text{First}(B) = \{\, b, \varepsilon \,\}$;
$\text{First}(C) = \{\, c, \,\}$;
$\text{First}(D) = \{\, d, \varepsilon \,\}$;

(2) $\text{Follow}(S) = \{\, \$ \,\}$;
$\text{Follow}(A) = \{\, b \,\}$;
$\text{Follow}(B) = \{\, \$ \,\}$;
$\text{Follow}(C) = \{\, a, d \,\}$;
$\text{Follow}(D) = \{\, a \,\}$;

(3) 不是LL(1)文法；因为：$\text{Select}(S \to AB) = \{\, a \,\}$; $\text{Select}(S \to CDa) = \{\, c, d, a \,\}$, 所以$\text{Select}(S \to AB) \cap \text{Select}(S \to CDa) \neq \emptyset$

四、 (1) 对集合表达式“$a \cap a \cup a$”有两个不同的最左推导：

$$
\begin{aligned}
S &\underset{lm}{\Longrightarrow} S \cap S \\
&\underset{lm}{\Longrightarrow} a \cap S \\
&\underset{lm}{\Longrightarrow} a \cap S \cup S \\
&\underset{lm}{\Longrightarrow} a \cap a \cup S \\
&\underset{lm}{\Longrightarrow} a \cap a \cup a
\end{aligned}
\qquad\Big|\qquad
\begin{aligned}
S &\underset{lm}{\Longrightarrow} S \cup S \\
&\underset{lm}{\Longrightarrow} S \cap S \cup S \\
&\underset{lm}{\Longrightarrow} a \cap S \cup S \\
&\underset{lm}{\Longrightarrow} a \cap a \cup S \\
&\underset{lm}{\Longrightarrow} a \cap a \cup a
\end{aligned}
$$

(2)

$$\begin{array}{rcl} S & \to & D-S \,|\, D \\ D & \to & D \cup U \,|\, U \\ U & \to & U \cap X \,|\, X \\ X & \to & -X \,|\, A \\ A & \to & (S) \,|\, a \end{array}$$

五、 (1)

$$I_5 = \{\ S \to S \cup \bullet S,\ S \to \bullet S \cap S,\ S \to \bullet S \cup S,\ S \to \bullet S - S,\ S \to \bullet - S,\ S \to \bullet(S),\ S \to \bullet a\ \}$$

$$I_{10} = \{\ S \to (S\bullet),\ S \to S \bullet \cap S,\ S \to S \bullet \cup S,\ S \to S \bullet - S\ \}$$

(2)

state	action							goto
	$\cap$	$\cup$	$-$	(	)	a	\$	S
0	/	/	s1	s9	/	s12	/	13
1	/	/	s1	s9	/	s12	/	2
2	r4	r4	r4	/	r4	/	r4	/
3	/	/	s1	s9	/	s12	/	4
4	r1	r1	r1	/	r1	/	r1	/
5	/	/	s1	s9	/	s12	/	6
6	s3	r2	r2	/	r2	/	r2	/
7	/	/	s1	s9	/	s12	/	8
8	s3	s5	s7	/	r3	/	r3	/
9	/	/	s1	s9	/	s12	/	10
10	s3	s5	s7	/	s11	/	/	/
11	r5	r5	r5	/	r5	/	r5	/
12	r6	r6	r6	/	r6	/	r6	/
13	s3	s5	s7	/	/	/	acc	/

(3)

	stack	input	action
(1)	I_0	$-a \cup a - a\$$	shift
(2)	$I_0 - I_1$	$a \cup a - a\$$	shift
(3)	$I_0 - I_1 a I_{12}$	$\cup a - a\$$	reduce $S \to a$
(4)	$I_0 - I_1 S I_2$	$\cup a - a\$$	reduce $S \to -S$
(5)	$I_0 S I_{13}$	$\cup a - a\$$	shift
(6)	$I_0 S I_{13} \cup I_5$	$a - a\$$	shift
(7)	$I_0 S I_{13} \cup I_5 a I_{12}$	$-a\$$	reduce $S \to a$
(8)	$I_0 S I_{13} \cup I_5 S I_6$	$-a\$$	reduce $S \to S \cup S$
(9)	$I_0 S I_{13}$	$-a\$$	shift
(10)	$I_0 S I_{13} - I_7$	$a\$$	shift
(11)	$I_0 S I_{13} - I_7 a I_{12}$	\$	reduce $S \to a$
(12)	$I_0 S I_{13} - I_7 S I_8$	\$	reduce $S \to S - S$
(13)	$I_0 S I_{13}$	\$	accept

六、 (1)

语法	语义规则
$E \to id \in S$	$S.\text{true} := E.\text{true};\ S.\text{false} := E.\text{false};$ $S.\text{element} := id.\text{name};\ E.\text{code} := S.\text{code};$
$S \to a$	$S.\text{code} := \text{gen}(\texttt{"if"}, S.\text{element}, \texttt{"in"}, a.\text{name}, \texttt{"goto"}, S.\text{true}) \parallel$ $\text{gen}(\texttt{"goto"}, S.\text{false});$
$S \to S_1 \cap S_2$	$S_1.\text{true} := \text{newlabel}();\ S_1.\text{false} := S.\text{false};$ $S_2.\text{true} := S.\text{true};\ S_2.\text{false} := S.\text{false};$ $S.\text{code} := S_1.\text{code} \parallel \text{gen}(S_1.\text{true}, \texttt{":"}) \parallel S_2.\text{code};$ $S_1.\text{element} := S.\text{element};\ S_2.\text{element} := S.\text{element};$
$S \to S_1 \cup S_2$	$S_1.\text{true} := S.\text{true};\ S_1.\text{false} := \text{newlabel}();$ $S_2.\text{true} := S.\text{true};\ S_2.\text{false} := S.\text{false};$ $S.\text{code} := S_1.\text{code} \parallel \text{gen}(S_1.\text{false}, \texttt{":"}) \parallel S_2.\text{code};$ $S_1.\text{element} := S.\text{element};\ S_2.\text{element} := S.\text{element};$
$S \to S_1 - S_2$	$S_1.\text{true} := \text{newlabel}();\ S_1.\text{false} := S.\text{false};$ $S_2.\text{true} := S.\text{false};\ S_2.\text{false} := S.\text{true};$ $S.\text{code} := S_1.\text{code} \parallel \text{gen}(S_1.\text{true}, \texttt{":"}) \parallel S_2.\text{code};$ $S_1.\text{element} := S.\text{element};\ S_2.\text{element} := S.\text{element};$
$S \to -S_1$	$S_1.\text{true} := S.\text{false};\ S_1.\text{false} := S.\text{true};$ $S.\text{code} := S_1.\text{code};$ $S_1.\text{element} := S.\text{element};$
$S \to (S_1)$	$S_1.\text{true} := S.\text{true};\ S_1.\text{false} := S.\text{false};$ $S.\text{code} := S_1.\text{code};$ $S_1.\text{element} := S.\text{element};$

(2)

```
(1)     if x in A goto L2
(2)     goto L1
(3) L2: if x in B goto L1
(4)     goto Lfalse
(3) L1: if x in C goto Lfalse
(4)     goto Ltrue
```

七、 (1) call by name

```
4 3
3 4
```

(2) call by value

```
2 1
1 2
```

(3) call by reference

```
2 4
4 2
```

(4) call by value-result

```
2 1
4 2
```

八、 设main()在被调用时的frame pointer地址为x, 则main()被调用时AR如下：

程序1

address	memory	note
	.....	
x	fp	
x-4	ret add	
x-8	0	
x-9	'7'	
x-10	'6'	
x-11	'5'	
x-12	'4'	
x-13	'3'	
x-14	'2'	
x-15	'1'	← t
x-16	0	
x-17	'c'	
x-18	'b'	
x-19	'a'	← s
	.....	

程序2

address	memory	note
	.....	
x	fp	
x-4	ret add	
x-8	0	
x-9	'c'	
x-10	'b'	
x-11	'a'	← s
x-12	0	
x-13	'7'	
x-14	'6'	
x-15	'5'	
x-16	4	
x-17	'3'	
x-18	'2'	
x-19	'1'	← t
	.....	

执行"strcpy(s, t);"之后，main()的AR如下：

程序1

address	memory	note
	.....	
x	fp	
x-4	ret add	
x-8	0	
x-9	'7'	
x-10	'6'	
x-11	'5'	
x-12	0	
x-13	'7'	
x-14	'6'	
x-15	'5'	← t
x-16	'4'	
x-17	'3'	
x-18	'2'	
x-19	'1'	← s
	.....	

程序2

address	memory	note
	.....	
x	'6'	
x-4	'5'	返回地址被修改
x-8	'4'	
x-9	'3'	
x-10	'2'	
x-11	'1'	← s
x-12	0	
x-13	'7'	
x-14	'6'	
x-15	'5'	
x-16	4	
x-17	'3'	
x-18	'2'	
x-19	'1'	← t
	.....	

所以程序1在"strcpy(s, t);"之后数组t被修改为"567\0567\0", 最后打印输出"567"; 而程序2虽然能正确地将数组s赋值为"1234567\0", 但是产生了缓冲区溢出，程序返回时使用被修改的返回地址发生段错误而无法正常退出。