

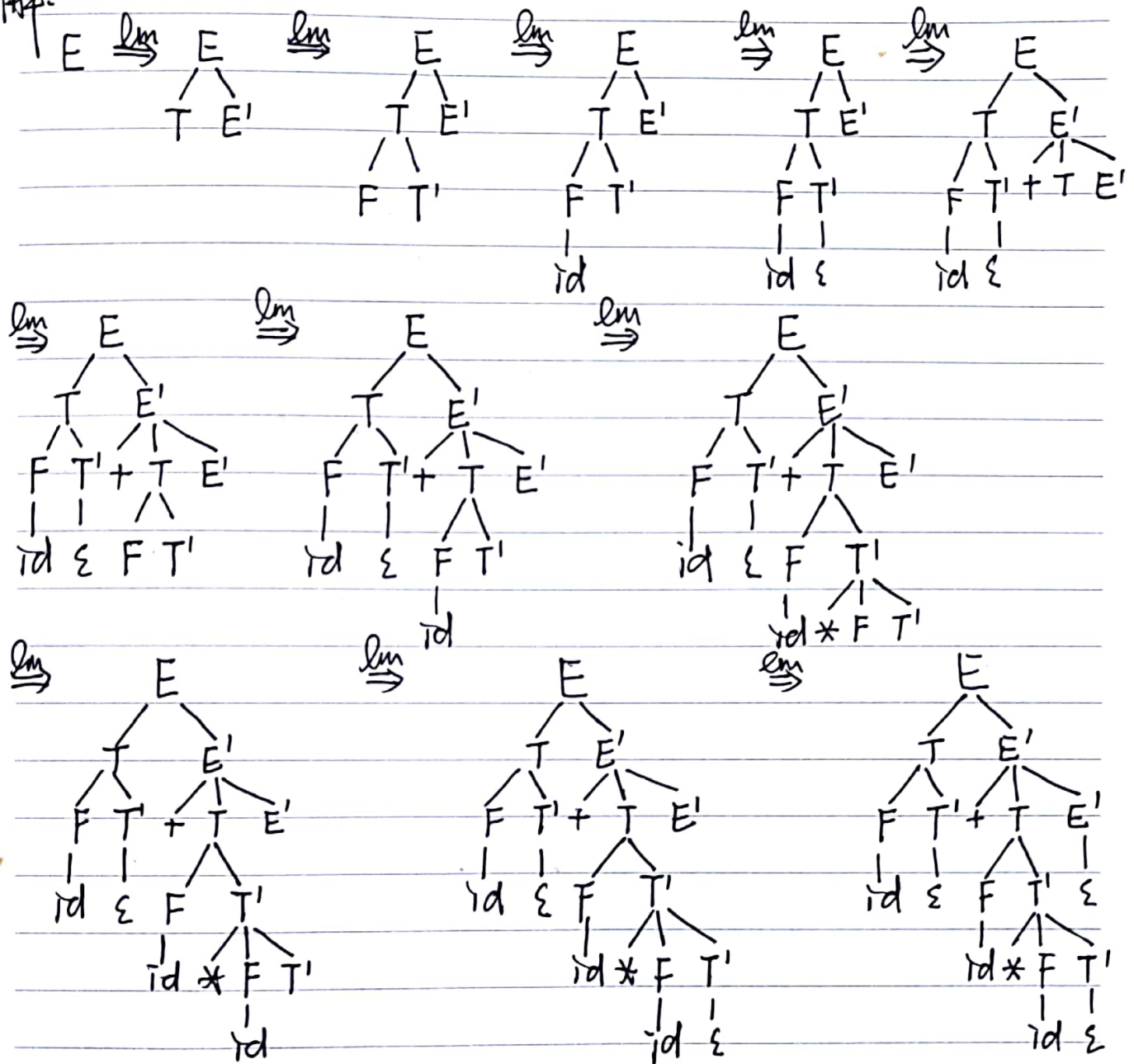
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姜文泽

一.  $id + id * id$  的语法分析树:

解:

二. (1) 原的文法 (左递归的): ~~消除左递归~~ $E \rightarrow E + T \mid T$  $T \rightarrow T * F \mid F$  $F \rightarrow (E) \mid id$ 

改进文法

 $E \rightarrow TE'$  $E' \rightarrow +TE' \mid \epsilon$  $T \rightarrow FT'$  $T' \rightarrow *FT' \mid \epsilon$  $F \rightarrow (E) \mid id$

12) 同理:

$$S \rightarrow Aa|b$$

$$A \rightarrow Ac|Sd|\epsilon$$

替换

$$S \rightarrow Aa|b$$

$$A \rightarrow Ac|Aad|bd|\epsilon$$

消去非

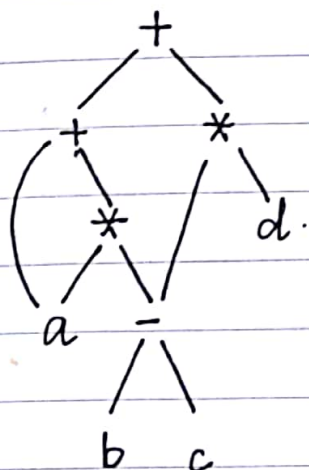
$$S \rightarrow Aa|b$$

$$A \rightarrow bdA'|A'$$

$$A' \rightarrow cA'|adA'|\epsilon$$

三、 $a + a * (b - c) + (b - c) * d$  的 DAG:

解:



四、u)  $x = (a + b) * c$ .

三地址码:

$$t_1 = a + b$$

$$t_2 = t_1 * c$$

$$x = t_2$$

12)  $a + a * (b - c) + (b - c) * d$ .

三地址码:

$$t_1 = b - c$$

$$t_2 = a * t_1$$

$$t_3 = a + t_2$$

$$t_4 = t_1 * d$$

$$t_5 = t_3 + t_4$$

五、三地址码的归并元式: [注: 不妨令每道题指令初始位置为 100, 数组中各元素占 8 单元]

u) do  $i = i + 1$ ; while ( $a[i] < v$ )

$$100: t_1 = i + 1$$

$$101: i = t_1$$

$$102: t_2 = i * 8$$

$$103: t_3 = a[t_2]$$

$$104: \text{if } t_3 < v \text{ goto } 100.$$

$$100: +, i, 1, t_1$$

$$101: =, t_1, , i$$

$$102: *, i, 8, t_2$$

$$103: =[], a[t_2], , t_3$$

$$104: j <, t_3, v, 100.$$

注:  $a$  指地址

12) for  $i=1; i < 100; i++$  {

$S = S + 1;$

}

100:  $i = 1$

101: if  $i \geq 100$  goto 107

102:  $t_1 = S + 1$

103:  $S = t_1$

104:  $t_2 = i + 1$

105:  $i = t_2$

106: goto 101

107: ..

100:  $=, 1, , i$

101:  $j \geq, i, 100, 107$

102:  $=, S, 1, t_1$

103:  $=, t_1, , S$

104:  $=, i, 1, t_2$

105:  $=, t_2, , i$

106:  $j, , , 101$

107: ..

13) if  $a < b$  then  $x = a + b$  else  $x = a - b$

100: if  $a \geq b$  goto 104

101:  $t_1 = a + b$

102:  $x = t_1$

103: goto 106

104:  $t_2 = a - b$

105:  $x = t_2$

106: ..

100:  $j \geq, a, b, 104$

101:  $=, a, b, t_1$

102:  $=, t_1, , x$

103:  $j, , , 106$

104:  $-, a, b, t_2$

105:  $=, t_2, , x$

106: ..

14)  $a = b * -c + b * -c$

100:  $t_1 = \text{minus } c$

101:  $t_2 = b * t_1$

102:  $t_3 = \text{minus } c$

103:  $t_4 = b * t_3$

104:  $t_5 = t_2 + t_4$

105:  $a = t_5$

100:  $\text{minus}, c, , t_1$

101:  $*, b, t_1, t_2$

102:  $\text{minus}, c, , t_3$

103:  $*, b, t_3, t_4$

104:  $+, t_2, t_4, t_5$

105:  $=, t_5, , a$



15) while (a < b) {  
     if (a < b) then x = y + z;  
 }

100: if a > b goto 105  
 101: if a > b goto 104  
 102: t<sub>1</sub> = y + z  
 103: x = t<sub>1</sub>  
 104: goto 100  
 105: ..

100: j >, a, b, 105  
 101: j > a, b, 104  
 102: +, y, z, t<sub>1</sub>  
 103: =, t<sub>1</sub>, , x  
 104: j goto , , 100  
 105: ..

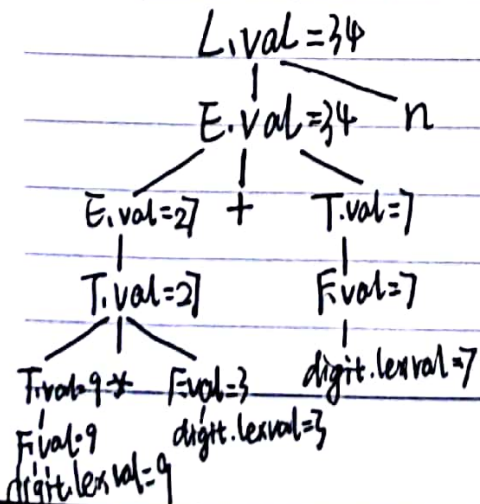
六. if (a > b or c > d) x = x + 1  
     else x = x - 1

四元式: ~~100~~ 从地址100开始:

100: j >, a, b, 102  
 101: j ≤, c, d, 105  
 102: +, x, 1, t<sub>1</sub>  
 103: =, t<sub>1</sub>, , x  
 104: j, , , 107  
 105: -, x, 1, t<sub>2</sub>  
 106: =, t<sub>2</sub>, , x  
 107: ..

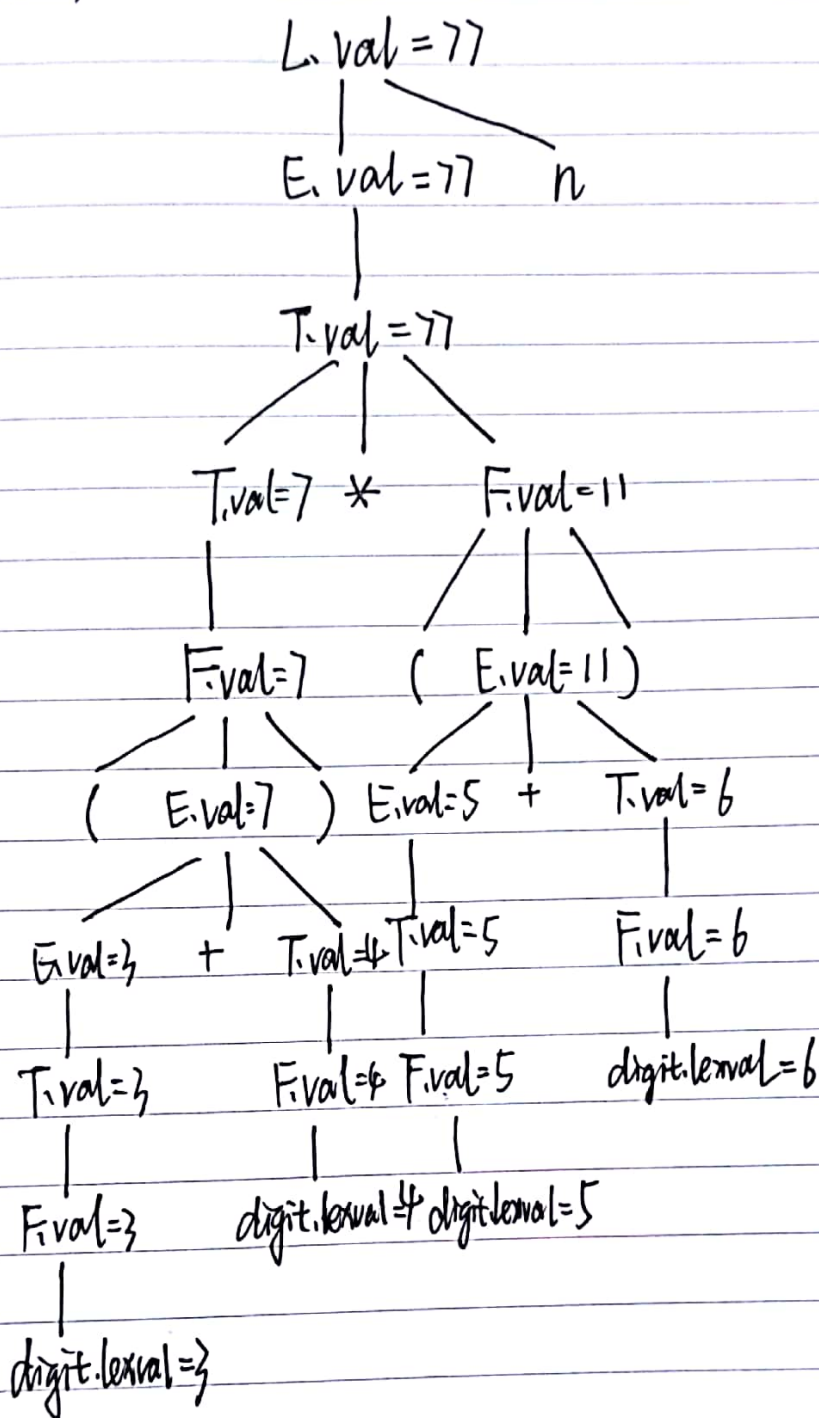
七. 利用课本 P183. 5-1 的文法和规则构造:

1.  $9 * 3 + 7 / n$ :



2.  $(3+4) * (5+6) n$

解:



八. 正则表达式:

1) 十进制整数:  $(+|-|\epsilon)(1|2|3|\dots|9)(0|1|2|\dots|9)^* | 0$ , 可简写为  $(+|-|\epsilon)[1-9][0-9]^* | 0$

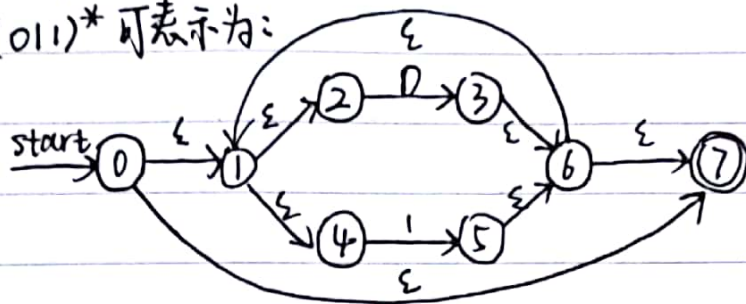
12)  $\Sigma = \{0,1\}$ , 仅含两个1:  $0^*10^*10^*$

13)  $\Sigma = \{a,b\}$ , abb开头:  $abb(a|b)^*$

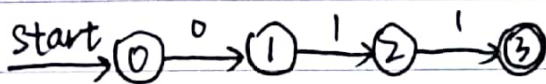
14) 01结尾的二进制:  $(0|1)^*01$

解九. (1) 原題即求  $(011)^* 011 (011)^*$  的 NFA.

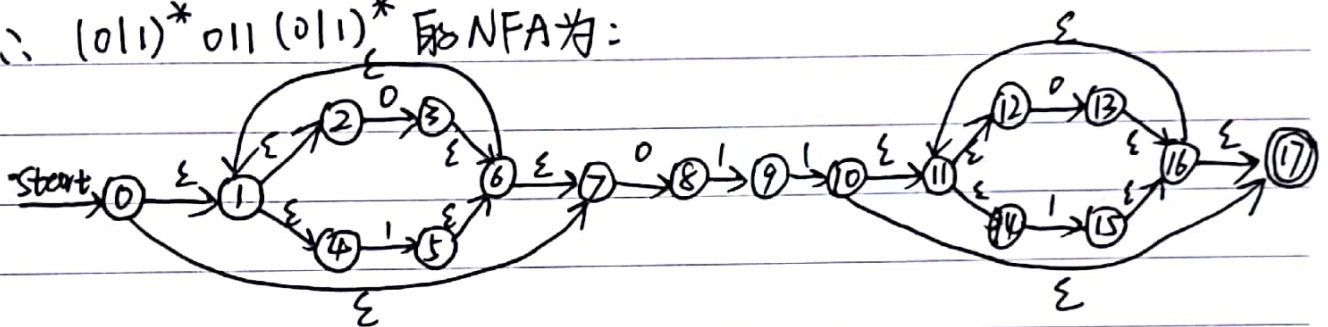
$(011)^*$  可表示为:



$011$  可表示为:



$\therefore (011)^* 011 (011)^*$  的 NFA 为:



12) 对 (1) 的 NFA 有: 可接受 0, 1, DFA 状态为 A, B, C...

$$A = \epsilon\text{-closure}(0) = \{0, 1, 2, 4, 7\}$$

$$\text{move}(A, 0) = \{3, 8\} \quad \text{Dtran}[A, 0] = \epsilon\text{-closure}(\{3, 8\}) = \{1, 2, 3, 4, 6, 7, 8\} = B$$

$$\text{move}(A, 1) = \{5\} \quad \text{Dtran}[A, 1] = \epsilon\text{-closure}(\{5\}) = \{1, 2, 4, 5, 6, 7\} = C$$

$$\text{move}(B, 0) = \{3, 8\} \quad \text{Dtran}[B, 0] = \epsilon\text{-closure}(\{3, 8\}) = B$$

$$\text{move}(B, 1) = \{5, 9\} \quad \text{Dtran}[B, 1] = \epsilon\text{-closure}(\{5, 9\}) = \{1, 2, 4, 5, 6, 7, 9\} = D$$

$$\text{move}(C, 0) = \{3, 8\} \quad \text{Dtran}[C, 0] = \epsilon\text{-closure}(\{3, 8\}) = B$$

$$\text{move}(C, 1) = \{5\} \quad \text{Dtran}[C, 1] = \epsilon\text{-closure}(\{5\}) = C$$

$$\text{move}(D, 0) = \{3, 8\} \quad \text{Dtran}[D, 0] = \epsilon\text{-closure}(\{3, 8\}) = B$$

$$\text{move}(D, 1) = \{5, 10\} \quad \text{Dtran}[D, 1] = \epsilon\text{-closure}(\{5, 10\}) = \{1, 2, 4, 5, 6, 7, 10, 11, 12, 14, 17\} = E$$

$$\text{move}(E, 0) = \{3, 8, 13\} \quad \text{Dtran}[E, 0] = \epsilon\text{-closure}(\{3, 8, 13\}) = \{1, 2, 3, 4, 6, 7, 8, 11, 12, 13, 14, 16, 17\} = F$$

$$\text{move}(E, 1) = \{5, 15\} \quad \text{Dtran}[E, 1] = \epsilon\text{-closure}(\{5, 15\}) = \{1, 2, 4, 5, 6, 7, 11, 12, 14, 15, 16, 17\} = G$$

$$\text{move}(F, 0) = \{3, 8, 13\} \quad \text{Dtran}[F, 0] = \epsilon\text{-closure}(\{3, 8, 13\}) = F$$



$\text{move}(F,1) = \{5,9,15\}$   $\text{Dtran}[F,1] = \varepsilon\text{-closure}(\{5,9,15\}) = \{1,2,4,5,6,7,9,11,12,14,15,16,17\} = H$

$\text{move}(G,0) = \{3,8,13\}$   $\text{Dtran}[G,0] = \varepsilon\text{-closure}(\{3,8,13\}) = F$

$\text{move}(G,1) = \{5,15\}$   $\text{Dtran}[G,1] = \varepsilon\text{-closure}(\{5,15\}) = G$

$\text{move}(H,0) = \{3,8,13\}$   $\text{Dtran}[H,0] = \varepsilon\text{-closure}(\{3,8,13\}) = F$

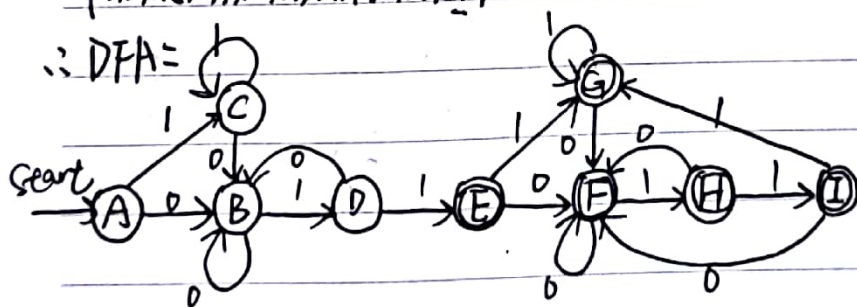
$\text{move}(H,1) = \{5,10,15\}$   $\text{Dtran}[H,1] = \varepsilon\text{-closure}(\{5,10,15\}) = \{1,2,4,5,6,7,10,11,12,14,15,16,17\} = I$

$\text{move}(I,0) = \{3,8,13\}$   $\text{Dtran}[I,0] = \varepsilon\text{-closure}(\{3,8,13\}) = F$

$\text{move}(I,1) = \{5,15\}$   $\text{Dtran}[I,1] = \varepsilon\text{-closure}(\{5,15\}) = G$

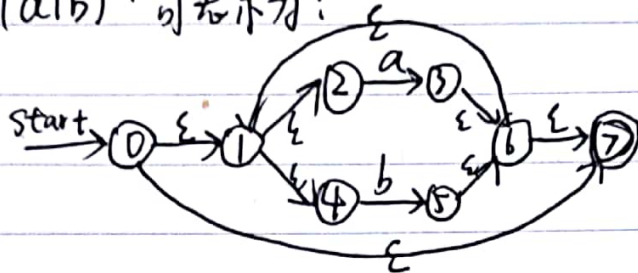
$\therefore$  转换表  $\text{Dtran}$  为:

NFA状态	DFA状态	0	1
$\{0,1,2,4,7\}$	A (start)	B	C
$\{1,2,3,4,6,7,8\}$	B	B	D
$\{1,2,4,5,6,7\}$	C	B	C
$\{1,2,4,5,6,7,9\}$	D	B	E
$\{1,2,4,5,6,7,10,11,12,14,17\}$	E $\odot$	F	G
$\{1,2,3,4,6,7,8,11,12,13,14,16,17\}$	F $\odot$	F	H
$\{1,2,4,5,6,7,11,12,14,15,16,17\}$	G $\odot$	F	G
$\{1,2,4,5,6,7,9,11,12,14,15,16,17\}$	H $\odot$	F	I
$\{1,2,4,5,6,7,10,11,12,14,15,16,17\}$	I $\odot$	F	G

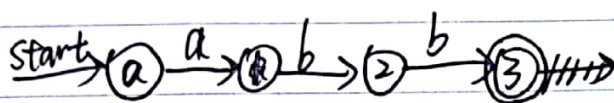


1. NFA  $(a|b)^*abb$

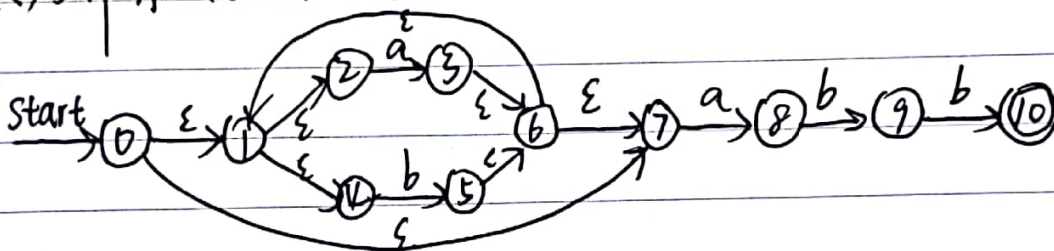
解:  $(a|b)^*$  可表示为:



$abb$  可表示为:



合并有:  $(a|b)^*abb$  的 NFA:



+- 有文法  $G =$

$E \rightarrow TE'$

$E' \rightarrow +E | \epsilon$

$T \rightarrow FT'$

$T' \rightarrow T | \epsilon$

$F \rightarrow PF'$

~~$F' \rightarrow *F'$~~

$F' \rightarrow *F' | \epsilon$

$P \rightarrow (E) | a | b | ^$

1)  $FIRST(E) = FIRST(T) = FIRST(F) = FIRST(P) = \{ (, a, b, ^ \}$

$FIRST(E') = \{ +, \epsilon \}$

$FIRST(T') = \{ (, a, b, ^, \epsilon \}$

$FIRST(F') = \{ *, \epsilon \}$

$FOLLOW(E) = \{ ), \$ \}$

$FOLLOW(E') = \{ ), \$, \}$

$FOLLOW(T) = \{ +, ), \$ \}$

$FOLLOW(T') = \{ +, ), \$ \}$

$FOLLOW(F) = \{ (, a, b, ^, +, ), \$ \}$

$FOLLOW(F') = \{ (, a, b, ^, +, ), \$ \}$

$FOLLOW(P) = \{ *, (, a, b, ^, +, ), \$ \}$



(空处为 error)

非终结符号	输入符号							
	a	b	+	*	^	(	)	\$
E	$E \rightarrow TE'$	$E \rightarrow TE'$			$E \rightarrow TE'$	$E \rightarrow TE'$		
E'			$E' \rightarrow +E$				$E' \rightarrow \epsilon$	$E' \rightarrow \epsilon$
T	$T \rightarrow FE'$	$T \rightarrow FT'$			$T \rightarrow FT'$	$T \rightarrow FT'$		
T'	$T' \rightarrow T$	$T' \rightarrow T$	$T' \rightarrow \epsilon$		$T' \rightarrow T$	$T' \rightarrow T$	$T' \rightarrow \epsilon$	$T' \rightarrow \epsilon$
F	$F \rightarrow PF'$	$F \rightarrow PF'$			$F \rightarrow PF'$	$F \rightarrow PF'$		
F'	$F' \rightarrow \epsilon$	$F' \rightarrow \epsilon$	$F' \rightarrow \epsilon$	$F' \rightarrow *F'$	$F' \rightarrow \epsilon$	$F' \rightarrow \epsilon$	$F' \rightarrow \epsilon$	$F' \rightarrow \epsilon$
P	$P \rightarrow a$	$P \rightarrow b$			$P \rightarrow ^$	$P \rightarrow (E)$		

十、有文法G:

$$S \rightarrow iEtSS' \mid a.$$

$$S' \rightarrow eS \mid \epsilon$$

$$E \rightarrow b$$

$$\text{FIRST}(S) = \{i, a\}$$

$$\text{FIRST}(S') = \{e, \epsilon\}$$

$$\text{FIRST}(E) = \{b\}$$

$$\text{FOLLOW}(S) = \{e, \$\}$$

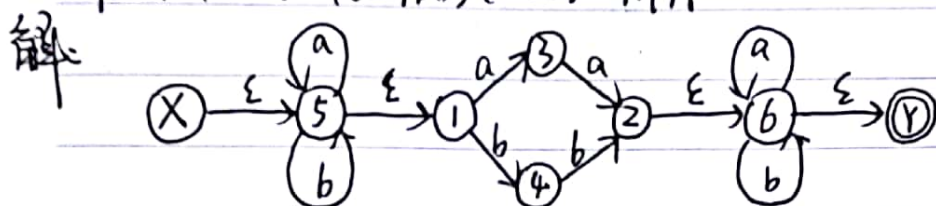
$$\text{FOLLOW}(S') = \{e, \$\}$$

$$\text{FOLLOW}(E) = \{b\}$$

(空处为 error)

非终结符号	输入符号					
	a	b	e	i	t	\$
S	$S \rightarrow a$			$S \rightarrow iEtSS'$		
S'			$S' \rightarrow eS$ $S' \rightarrow \epsilon$			$S' \rightarrow \epsilon$
E'		$E \rightarrow b$				

十三、 $(a|b)^*(a|bb)(a|b)^*$  NFA:



不全 DFA 状态为 A, B, C, ... (除 X, Y), 可接受 a, b.

$$A = \epsilon\text{-closure}(X) = \{X, 5, 1\}$$

$$\text{move}(A, a) = \{5, 3\} \quad \text{Dtran}[A, a] = \epsilon\text{-closure}(\{5, 3\}) = \{1, 3, 5\} = B$$

$$\text{move}(A, b) = \{5, 4\} \quad \text{Dtran}[A, b] = \epsilon\text{-closure}(\{5, 4\}) = \{1, 4, 5\} = C$$

$$\text{move}(B, a) = \{2, 3, 5\} \quad \text{Dtran}[B, a] = \epsilon\text{-closure}(\{2, 3, 5\}) = \{1, 2, 3, 5, 6, Y\} = D$$

$$\text{move}(B, b) = \{4, 5\} \quad \text{Dtran}[B, b] = \epsilon\text{-closure}(\{4, 5\}) = \{1, 4, 5\} = C$$

$$\text{move}(C, a) = \{3, 5\} \quad \text{Dtran}[C, a] = \epsilon\text{-closure}(\{3, 5\}) = B$$

$$\text{move}(C, b) = \{2, 4, 5\} \quad \text{Dtran}[C, b] = \epsilon\text{-closure}(\{2, 4, 5\}) = \{1, 2, 4, 5, 6, Y\} = E$$

$$\text{move}(D, a) = \{2, 3, 5, 6\} \quad \text{Dtran}[D, a] = \epsilon\text{-closure}(\{2, 3, 5, 6\}) = D$$

$$\text{move}(D, b) = \{4, 5, 6\} \quad \text{Dtran}[D, b] = \epsilon\text{-closure}(\{4, 5, 6\}) = \{1, 4, 5, 6, Y\} = F$$

$$\text{move}(E, a) = \{3, 5, 6\} \quad \text{Dtran}[E, a] = \epsilon\text{-closure}(\{3, 5, 6\}) = \{1, 3, 5, 6, Y\} = G$$

$$\text{move}(E, b) = \{2, 4, 5, 6\} \quad \text{Dtran}[E, b] = \epsilon\text{-closure}(\{2, 4, 5, 6\}) = E$$

$$\text{move}(F, a) = \{3, 5, 6\} \quad \text{Dtran}[F, a] = \epsilon\text{-closure}(\{3, 5, 6\}) = G$$

$$\text{move}(F, b) = \{2, 4, 5, 6\} \quad \text{Dtran}[F, b] = \epsilon\text{-closure}(\{2, 4, 5, 6\}) = E$$

$$\text{move}(G, a) = \{2, 3, 5, 6\} \quad \text{Dtran}[G, a] = \epsilon\text{-closure}(\{2, 3, 5, 6\}) = D$$

$$\text{move}(G, b) = \{4, 5, 6\} \quad \text{Dtran}[G, b] = \epsilon\text{-closure}(\{4, 5, 6\}) = F$$

转移表: NFA 状态

DFA 状态

a

b

$\{X, 1, 5\}$

A (start)

B

C

$\{1, 3, 5\}$

B

D

C

$\{1, 4, 5\}$

C

B

E

$\{1, 2, 3, 5, 6, Y\}$

D ○

D

F

$\{1, 2, 4, 5, 6, Y\}$

E ○

G

E

$\{1, 4, 5, 6, Y\}$

F ○

G

E

$\{1, 3, 5, 6, Y\}$

G ○

D

F

DFA:

