

$$1. (1) A: FIRST(BCc) = \{a, b, c, d\} \quad FIRST(eDB) = \{e\}$$

$$B: FIRST(\varepsilon) = \{\varepsilon\} \quad FIRST(bcD) = \{b\}$$

$$FOLLOW(B) = \{c, d, a, \#\}$$

$$C: FIRST(DaB) = \{d, a\} \quad FIRST(ca) = \{c\}$$

$$D: FIRST(\varepsilon) = \{\varepsilon\} \quad FIRST(dD) = \{d\}$$

$$FOLLOW(D) = \{b, a, c, d, \#\}$$

$$FIRST(dD) \cap FOLLOW(D) = \{d\} \neq \emptyset$$

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(2)

	a	b	c	d	e	#
A	$A \rightarrow BCc$	$A \rightarrow BCc$	$A \rightarrow BCc$	$A \rightarrow BCc$	$A \rightarrow eDB$	
B	$B \rightarrow \varepsilon$	$B \rightarrow bcD$	$B \rightarrow \varepsilon$	$B \rightarrow \varepsilon$		$B \rightarrow \varepsilon$
C	$C \rightarrow DaB$		$C \rightarrow ca$	$C \rightarrow DaB$		
D	$D \rightarrow \varepsilon$	$D \rightarrow \varepsilon$	$D \rightarrow \varepsilon$	$D \rightarrow dD$ $D \rightarrow \varepsilon$		$D \rightarrow \varepsilon$

该文法不是 LL(1) 文法。

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2. 1)  $\langle \text{program} \rangle$  :  $\text{FIRST}(\text{begin } \langle \text{stmt} \rangle \text{ end}) = \{\text{begin}\}$

$\langle \text{stmt} \rangle$  :  $\text{FIRST}(d; \langle \text{stmt} \rangle) = \{d\}$   $\text{FIRST}(s \langle \text{tail} \rangle) = \{s\}$

$\langle \text{tail} \rangle$  :  $\text{FIRST}(\epsilon) = \{\epsilon\}$   $\text{FIRST}(\langle \text{tail} \rangle) = \{;\}$

$\text{FOLLOW}(\langle \text{tail} \rangle) = \{\text{end}\}$

	begin	end	d	;	s	#
$\langle \text{program} \rangle$	$\langle \text{program} \rangle \rightarrow \text{begin} \langle \text{stmt} \rangle \text{end}$					
$\langle \text{stmt} \rangle$	$\langle \text{stmt} \rangle \rightarrow d; \langle \text{stmt} \rangle \quad \langle \text{stmt} \rangle \rightarrow s \langle \text{tail} \rangle$					
$\langle \text{tail} \rangle$	$\langle \text{tail} \rangle \rightarrow \epsilon \quad \langle \text{tail} \rangle \rightarrow ; \langle \text{tail} \rangle$					

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(2)	步骤	分析栈	余留输入串	所用产生式
1		# <program>	begin d ; send #	<program> $\rightarrow$ begin <stmt> end
2		# end <stmt> begin	begin d ; send #	p++
3		# end <stmt>	d ; send #	<stmt> $\rightarrow$ d ; <stmt>
4		# end <stmt> ; d	d ; send #	p++
5		# end <stmt> ;	; send #	p++
6		# end <stmt>	S end #	<stmt> $\rightarrow$ S <tail>
7		# end <tail> S	S end #	p++
8		# end <tail>	end #	<tail> $\rightarrow \epsilon$
9		# end	end #	p++
10		#	#	分析成功

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3. (1) 不是. 因为  $A \rightarrow aA|a$  存在左公因子.

改写:  $S \rightarrow Ab|Ba$   $A \rightarrow aA'$   $A' \rightarrow A|\epsilon$   $B \rightarrow a$

(2) 不是. 因为  $M \rightarrow MaH|H$  存在左递归.

$H \rightarrow b(M)|(M)|b$  存在左公因子

改写:  $M \rightarrow HM'$   $M' \rightarrow aHM'|\epsilon$   $H \rightarrow bH'|(M)$   
 $H' \rightarrow (M)|\epsilon$

(3) 不是. 因为  $B \rightarrow Db|D$  存在左公因子.

改写:  $S \rightarrow AB$   $A \rightarrow Ba|\epsilon$   $B \rightarrow DB'$   $B' \rightarrow b|\epsilon$   $D \rightarrow d|\epsilon$

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(4)  $FIRST(baB) = \{b\}$   $FOLLOW(A) = \{b, \#\}$   
 $FIRST(baB) \cap FOLLOW(A) \neq \emptyset$   
 $\therefore$  不是 LL(1) 文法。

(5)  $A \rightarrow Ba \rightarrow Cba \rightarrow Acba$  存在间接左递归  
改写:  $A \rightarrow Acba | a$   $B \rightarrow Cb | b$   $C \rightarrow Ac | c$

$A \rightarrow aA'$   $A' \rightarrow cbaA' | \epsilon$   $B \rightarrow Cb | b$   $C \rightarrow Ac | c$

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