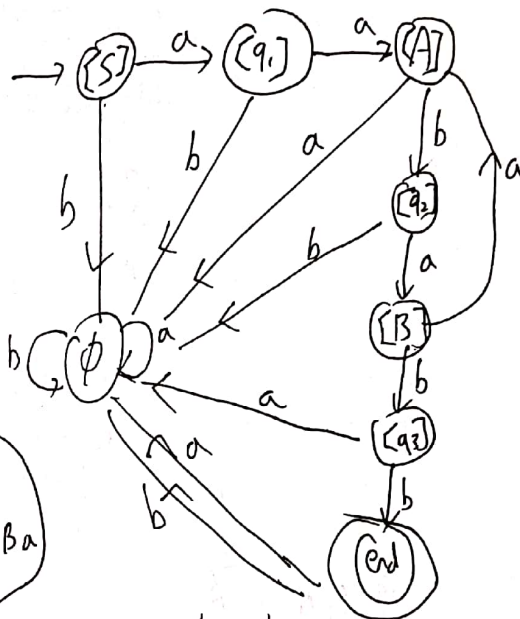
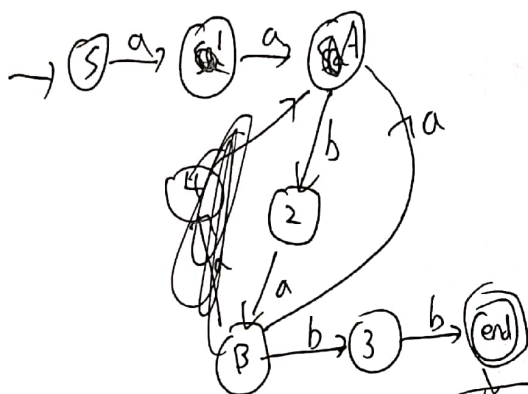


end $\rightarrow Bbb$
 $B \rightarrow A|Aba$
 $A \rightarrow Ba|Saa$
 $S \rightarrow \epsilon$
 201703289

1. 先做 NFA

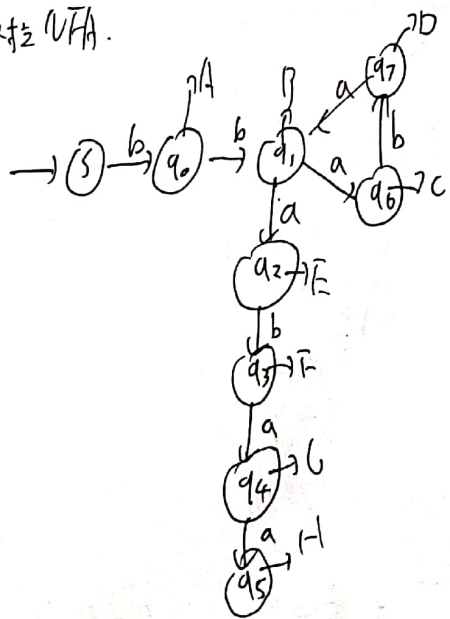
图改求 DFA



$L = aa \text{ } \overline{ba} (aba)^* bb$

$L^R = bb (aba)^* abaa$

对 NFA.



~~先做 NFA~~

~~$A \rightarrow Saa | Ba$~~

~~$B \rightarrow A|Aba$~~

~~$S \rightarrow \epsilon$~~

$S \rightarrow baq_0$
 $q_0 \rightarrow baq_1$
 $q_1 \rightarrow aq_2$

$S \rightarrow bA$
 $A \rightarrow bB$
 $B \rightarrow aC | aE$
 $C \rightarrow bD$
 $D \rightarrow aB$
 $E \rightarrow bF$
 $F \rightarrow aG$
 $G \rightarrow aH$
 $H \rightarrow \epsilon$

L^R Right Grammar

Left Grammar

$S \rightarrow Ab$
 $A \rightarrow Bb$
 $B \rightarrow Ca | Ea$
 $C \rightarrow Db$
 $D \rightarrow Ba$
 $E \rightarrow Fb$
 $F \rightarrow Ga$
 $G \rightarrow Ha$
 $H \rightarrow \epsilon$

Reverse 情况

$S \rightarrow aaA$
 $S^R \rightarrow A^Raa$

$A \rightarrow baB$

$A^R \rightarrow B^Rab$

$B \rightarrow aA|bb$

$B^R \rightarrow A^Ra|bb$

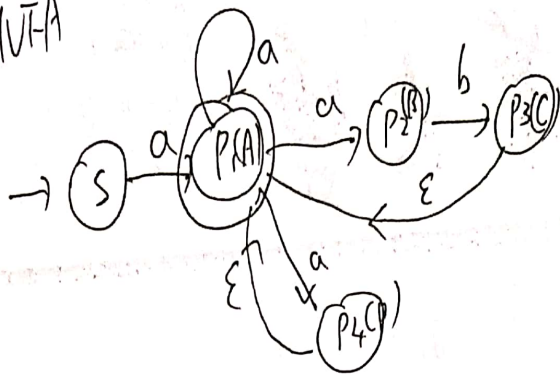
~~$L(G^R) = L(G)^R$~~

L^R 对应:

$S \rightarrow Aaa$
 $A \rightarrow Bab$
 $B \rightarrow Aa|bb$



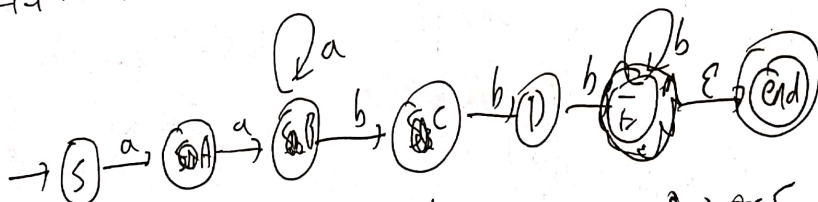
2. 画出 NFA



$S \rightarrow aA$
 $A \rightarrow \epsilon | aA | abA | a$

$S \rightarrow aA$
 $A \rightarrow \epsilon | aA | abA | a$
 $B \rightarrow bC$
 $C \rightarrow A$
 $D \rightarrow A$

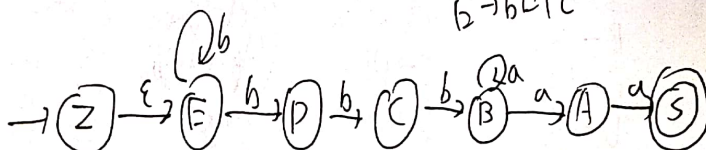
3. 画出 NFA



$S \rightarrow aA$
 $A \rightarrow aB$
 $B \rightarrow aB | bC$
 $C \rightarrow bD$
 $D \rightarrow bE$
 $E \rightarrow bE | \epsilon$

$A \rightarrow \epsilon$
 $B \rightarrow Aa | Ba$
 $C \rightarrow Cb | Db$
 $D \rightarrow Eb$
 $E \rightarrow Eb$
 $S \rightarrow \epsilon$
 $Z \rightarrow B$

画出 Reverse 的 NFA



Reverse 的 NFA 语言: Reverse 的 NFA 语言: 左 Lrarr:

$Z \rightarrow E$
 $E \rightarrow Eb | Db$
 $D \rightarrow Cb$
 $C \rightarrow Bb$
 $B \rightarrow Ba | Aa$
 $A \rightarrow Sa$
 $S \rightarrow \epsilon$



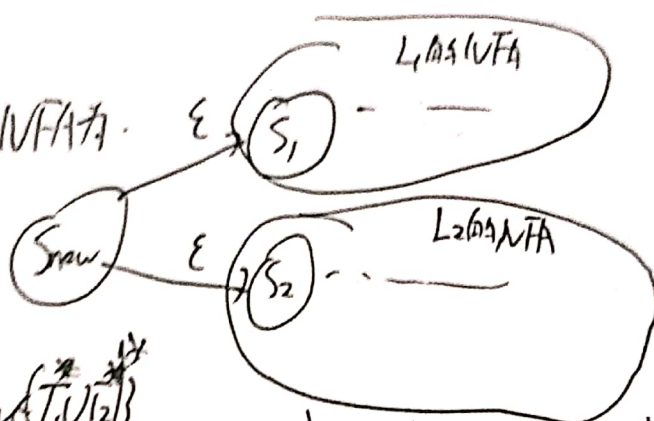
清华大学

4. (证明) 设 L_1 语言 $G_1 = (V_1, T_1, S_1, P_1)$

① L_2 语言 $G_2 = (V_2, T_2, S_2, P_2)$

(构造语言 $G_{new} = ((V_1 \cup V_2 \cup \{S_{new}\}), T_1 \cup T_2, S_{new}, P_1 \cup P_2 \cup \{S \rightarrow S_1, S \rightarrow S_2\})$)

② G_{new} 构造 NFA 为



, 即 $L_1 \cup L_2$ 的 NFA

$$L(G_{new}) = \{w \mid S \xRightarrow{*} w, w \in (T_1 \cup T_2)^*\}$$

$$= \{w \mid S_1 \xRightarrow{*} w, w \in T_1^*\} \cup \{w \mid S_2 \xRightarrow{*} w, w \in T_2^*\}$$

$$= L(G_1) \cup L(G_2)$$

证毕



② 构造 $G_{new} = (V_1 \cup V_2, T_1 \cup T_2, S_1, P_{new})$

其中 P_{new} 为 $P_1 \cup P_2$, 并对 P_1 中部分规则做如下修改:

(相当于两个 NFA:

以 S_1 为起始,

以 $\{T_2\}$ 为终结,

添加 T_1 与 S_2 的边)

若 $\exists A_i \in V$, 且有 $A \rightarrow \epsilon$,

$$L(G_{new}) = \{S_1 \xRightarrow{*} w / w \in (T_1 \cup T_2)^*\} \stackrel{\text{则一律改 } A \rightarrow S_2}{=} \{w_1 w_2 / w_1 \in (T_1)^*, w_2 \in (T_2)^*\}$$

$$\text{故有: } G_{new} = L_1 L_2$$

$$\therefore L_1 L_2 \in \text{Reg.}$$

$$\begin{aligned} & (S_1 \xRightarrow{*} w_1 / w_1 \in (T_1)^*) \\ & (S_2 \xRightarrow{*} w_2 / w_2 \in (T_2)^*) \end{aligned}$$

