

Autómatas y Lenguajes formales

Ejercicio Semanal 5

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1. Para cada lenguaje responda los incisos

- (a) Diseña un AFN (sin ϵ – transiciones) que acepte a L
- (b) Muestra el procesamiento formal de las cadenas $aabbbb$ y $abaab$ usando la función δ^* .
- (c) Transforma M a un AFD mediante la construcción de subconjuntos.

- $L = (a + b)^*(aaa + bbb)(a + b)^*$

(a) El autómata sería

$$M = \langle Q, \Sigma, \delta, q_0, F \rangle \text{ con}$$

$$Q = \{q_0, q_1, q_2, q_3, q_4, q_5\}$$

$$\Sigma = \{a, b\}$$

$$q_0 = q_0$$

$$F = \{q_5\}$$

Y con función de transición δ

δ	q_0	q_1	q_2	q_3	q_4	q_5
a	$\{q_0, q_1\}$	$\{q_2\}$	$\{q_5\}$	\emptyset	\emptyset	$\{q_5\}$
b	$\{q_0, q_3\}$	\emptyset	\emptyset	$\{q_4\}$	$\{q_5\}$	$\{q_5\}$

Con representación gráfica.

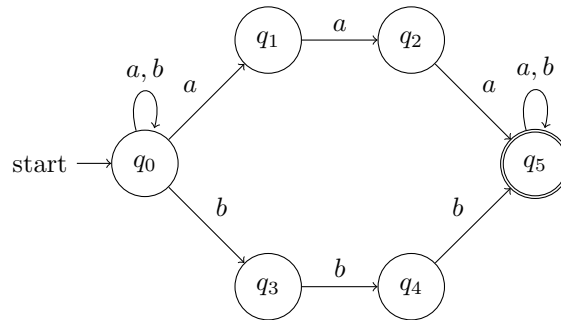


Figure 1: M que reconoce a L

(b) Procesamiento de las cadenas

– $aabbbb$

$$\begin{aligned}
\delta^*(\{q_0\}, aabbbb) &= \delta^*(\delta(q_0, a), abbbb) \\
&= \delta^*(\{q_0, q_1\}, abbbb) = \delta^*(\delta(q_0, a) \cup \delta(q_1, a), bbbb) \\
&= \delta^*(\{q_0, q_1, q_2\}, bbbb) = \delta^*(\delta(q_0, b) \cup \delta(q_1, b) \cup \delta(q_2, b), bbb) \\
&= \delta^*(\{q_0, q_3\}, bb) = \delta^*(\delta(q_0, b) \cup \delta(q_3, b), bb) \\
&= \delta^*(\{q_0, q_3, q_4\}, bb) = \delta^*(\delta(q_0, b) \cup \delta(q_3, b) \cup \delta(q_4, b), b) \\
&= \delta^*(\{q_0, q_3, q_4, q_5\}, b) = \delta^*(\delta(q_0, b) \cup \delta(q_3, b) \cup \delta(q_4, b) \cup \delta(q_5, b), \epsilon) \\
&= \delta^*(\{q_0, q_3, q_4, q_5\}, \epsilon) = \{q_0, q_3, q_4, q_5\}
\end{aligned}$$

Luego

$$\delta^*(\{q_0\}, aabbbb) \cap F = \{q_0, q_3, q_4, q_5\} \cap \{q_5\} = \{q_5\} \neq \emptyset$$

Por lo que $aabbbb$ sí es aceptado por el autómata.

– $abaab$

$$\begin{aligned}
\delta^*(\{q_0\}, abaab) &= \delta^*(\delta(q_0, a), baab) \\
&= \delta^*(\{q_0, q_1\}, baab) = \delta^*(\delta(q_0, b) \cup \delta(q_1, b), aab) \\
&= \delta^*(\{q_0, q_3\}, aab) = \delta^*(\delta(q_0, a) \cup \delta(q_3, a), ab) \\
&= \delta^*(\{q_0, q_1\}, ab) = \delta^*(\delta(q_0, a) \cup \delta(q_1, a), b) \\
&= \delta^*(\{q_0, q_1, q_2\}, b) = \delta^*(\delta(q_0, b) \cup \delta(q_1, b) \cup \delta(q_2, b), \epsilon) \\
&= \delta^*(\{q_0, q_3\}, \epsilon) = \{q_0, q_3\}
\end{aligned}$$

Luego

$$\delta^*(\{q_0\}, abaab) \cap F = \{q_0, q_3\} \cap \{q_5\} = \emptyset$$

Por lo que $abaab$ no es aceptado por el autómata.

(c) El equivalente determinista M^d de M sería

$$\begin{aligned}
M^d &= \langle Q^d, \Sigma, \delta^d, p_0, F^d \rangle \text{ con} \\
Q^d &= \mathcal{P}(Q) \\
\Sigma &= \{a, b\} \\
p_0 &= \{q_0\} \\
F^d &= \{S \in Q^d \mid S \cap F \neq \emptyset\}
\end{aligned}$$

En cuanto a δ^d , se construye a continuación usando subconjuntos.

$$\begin{aligned}
\delta^d(\{q_0\}, a) &= \{q_0, q_1\} \\
\delta^d(\{q_0\}, b) &= \{q_0, q_3\} \\
\delta^d(\{q_0, q_1\}, a) &= \{q_0, q_1, q_2\} \\
\delta^d(\{q_0, q_1\}, b) &= \{q_0, q_3\} \\
\delta^d(\{q_0, q_3\}, a) &= \{q_0, q_1\} \\
\delta^d(\{q_0, q_3\}, b) &= \{q_0, q_3, q_4\} \\
\delta^d(\{q_0, q_1, q_2\}, a) &= \{q_0, q_1, q_2, q_5\} \\
\delta^d(\{q_0, q_1, q_2\}, b) &= \{q_0, q_3\} \\
\delta^d(\{q_0, q_3, q_4\}, a) &= \{q_0, q_1\} \\
\delta^d(\{q_0, q_3, q_4\}, b) &= \{q_0, q_3, q_4, q_5\} \\
\delta^d(\{q_0, q_1, q_2, q_5\}, a) &= \{q_0, q_1, q_2, q_5\} \\
\delta^d(\{q_0, q_1, q_2, q_5\}, b) &= \{q_0, q_3, q_5\} \\
\delta^d(\{q_0, q_3, q_4, q_5\}, a) &= \{q_0, q_1, q_5\} \\
\delta^d(\{q_0, q_3, q_4, q_5\}, b) &= \{q_0, q_3, q_4, q_5\} \\
\delta^d(\{q_0, q_3, q_5\}, a) &= \{q_0, q_3, q_5\} \\
\delta^d(\{q_0, q_3, q_5\}, b) &= \{q_0, q_3, q_4, q_5\} \\
\delta^d(\{q_0, q_1, q_5\}, a) &= \{q_0, q_1, q_2, q_5\} \\
\delta^d(\{q_0, q_1, q_5\}, b) &= \{q_0, q_3, q_5\}
\end{aligned}$$

Luego, renombrando los estados

$$\begin{aligned}
p_0 &= \{q_0\}, p_1 = \{q_0, q_1\}, p_2 = \{q_0, q_3\}, p_3 = \{q_0, q_1, q_2\}, p_4 = \{q_0, q_3, q_4\}, \\
p_5 &= \{q_0, q_1, q_2, q_5\}, p_6 = \{q_0, q_3, q_4, q_5\}, p_7 = \{q_0, q_3, q_5\}, p_8 = \{q_0, q_1, q_5\}
\end{aligned}$$

Se puede describir δ^d de la siguiente manera

δ^d	p_0	p_1	p_2	p_3	p_4	p_5	p_6	p_7	p_8
a	p_1	p_3	p_1	p_5	p_1	p_5	p_8	p_7	p_5
b	p_2	p_2	p_4	p_2	p_6	p_7	p_6	p_6	p_8

- $L = \{a^n b^m \mid n + m \text{ es par}\}$