Lenguajes y Autómatas I

Respuesta de la Tarea 29

1. Diseñe y escriba las transiciones de una **MT** que permita decidir las cadenas para cada uno de los siguientes lenguajes, la **MT** deberá borrar la cadena de entrada y al final debe escribir un **1** en la cinta si la cadena es aceptada. (omita las transiciones de rechazo):

   a) $L = \{ w \in \{\mathbf{a}, \mathbf{b}\}^* \mid$ la longitud de w es par$\}$
   $\delta(q_0,\boldsymbol{\sigma}) = (q_1,\#,R)$, $\delta(q_1,\boldsymbol{\sigma}) = (q_0,\#,R)$, $\delta(q_0,\#) = (q_A,\mathbf{1},S)$

   b) $L = \{ w \in \{\mathbf{a}, \mathbf{b}\}^* \mid w$ contiene al menos una $\mathbf{a}\}$
   $\delta(q_0,\mathbf{a}) = (q_1,\#,R)$, $\delta(q_0,\mathbf{b}) = (q_0,\#,R)$, $\delta(q_1,\boldsymbol{\sigma}) = (q_1,\#,R)$, $\delta(q_1,\#) = (q_A,\mathbf{1},S)$

   c) $L = (\mathbf{aa} \cup \mathbf{bb})^*$
   $\delta(q_0,\mathbf{a}) = (q_1,\#,R)$, $\delta(q_1,\mathbf{a}) = (q_0,\#,R)$, $\delta(q_0,\mathbf{b}) = (q_2,\#,R)$, $\delta(q_2,\mathbf{b}) = (q_0,\#,R)$, $\delta(q_0,\#) = (q_A,\mathbf{1},S)$

   d) $L = \{\mathbf{a}^n\mathbf{b}^m \mid n, m \geq 0, m \neq n \}$
   $\delta(q_0,\mathbf{a}) = (q_1,\#,R)$, $\delta(q_1,\boldsymbol{\sigma}) = (q_1,\boldsymbol{\sigma},R)$, $\delta(q_1,\#) = (q_2,\#,L)$, $\delta(q_2,\mathbf{b}) = (q_3,\#,L)$, $\delta(q_3,\boldsymbol{\sigma}) = (q_3,\boldsymbol{\sigma},L)$, $\delta(q_3,\#) = (q_0,\#,R)$, $\delta(q_0,\mathbf{b}) = (q_4,\#,R)$, $\delta(q_4,\mathbf{b}) = (q_4,\#,R)$, $\delta(q_4,\#) = (q_A,\mathbf{1},S)$, $\delta(q_2,\mathbf{a}) = (q_5,\#,L)$, $\delta(q_5,\mathbf{a}) = (q_5,\#,L)$, $\delta(q_5,\#) = (q_A,\mathbf{1},S)$

   e) $L = \{ w \in \{\mathbf{a}, \mathbf{b}\}^* \mid w \neq w^R \}$
   $\delta(q_0,\mathbf{a}) = (q_1,\#,R)$, $\delta(q_1,\boldsymbol{\sigma}) = (q_1,\boldsymbol{\sigma},R)$, $\delta(q_1,\#) = (q_3,\#,L)$, $\delta(q_3,\mathbf{a}) = (q_5,\#,L)$, $\delta(q_0,\mathbf{b}) = (q_2,\#,R)$, $\delta(q_2,\boldsymbol{\sigma}) = (q_2,\boldsymbol{\sigma},R)$, $\delta(q_2,\#) = (q_4,\#,L)$, $\delta(q_4,\mathbf{b}) = (q_5,\#,L)$, $\delta(q_5,\boldsymbol{\sigma}) = (q_5,\boldsymbol{\sigma},L)$, $\delta(q_5,\#) = (q_0,\#,R)$, $\delta(q_4,\mathbf{a}) = (q_6,\#,L)$, $\delta(q_3,\mathbf{b}) = (q_6,\#,L)$, $\delta(q_6,\boldsymbol{\sigma}) = (q_6,\#,L)$, $\delta(q_6,\#) = (q_A,\mathbf{1},S)$

   f) $L = \{ w\mathbf{c}w \mid w \in \{\mathbf{a}, \mathbf{b}\}^* \}$
   $\delta(q_0,\mathbf{a}) = (q_1,\#,R)$, $\delta(q_1,\mathbf{a}) = (q_1,\mathbf{a},R)$, $\delta(q_1,\mathbf{b}) = (q_1,\mathbf{b},R)$, $\delta(q_1,\mathbf{c}) = (q_3,\mathbf{c},R)$, $\delta(q_3,\mathbf{a}) = (q_5,\mathbf{d},L)$, $\delta(q_3,\mathbf{d}) = (q_3,\mathbf{d},R)$, $\delta(q_0,\mathbf{b}) = (q_2,\#,R)$, $\delta(q_2,\mathbf{a}) = (q_2,\mathbf{a},R)$, $\delta(q_2,\mathbf{b}) = (q_2,\mathbf{b},R)$, $\delta(q_2,\mathbf{c}) = (q_4,\mathbf{c},R)$, $\delta(q_4,\mathbf{b}) = (q_5,\mathbf{d},L)$, $\delta(q_4,\mathbf{d}) = (q_4,\mathbf{d},R)$, $\delta(q_5,\boldsymbol{\sigma}) = (q_5,\boldsymbol{\sigma},L)$, $\delta(q_5,\#) = (q_0,\#,R)$, $\delta(q_0,\mathbf{c}) = (q_6,\#,R)$, $\delta(q_6,\mathbf{d}) = (q_6,\#,R)$, $\delta(q_6,\#) = (q_A,\mathbf{1},S)$

   g) $L = \{ w \in \{\mathbf{a}, \mathbf{b}, \mathbf{c}\}^* \mid w$ es una cadena de longitud par, no contiene ninguna **a** en la primera mitad y ninguna **b** en la segunda$\}$. Esto es, $w = xy$, donde $x \in \{\mathbf{b}, \mathbf{c}\}^*$, $y \in \{\mathbf{a}, \mathbf{c}\}^*$ y $|x| = |y|$.
   $\delta(q_0,\mathbf{b}) = (q_1,\#,R)$, $\delta(q_0,\mathbf{c}) = (q_1,\#,R)$, $\delta(q_1,\boldsymbol{\sigma}) = (q_1,\boldsymbol{\sigma},R)$, $\delta(q_1,\#) = (q_2,\#,L)$, $\delta(q_2,\mathbf{a}) = (q_3,\#,L)$, $\delta(q_2,\mathbf{c}) = (q_3,\#,L)$, $\delta(q_3,\boldsymbol{\sigma}) = (q_3,\boldsymbol{\sigma},L)$, $\delta(q_3,\#) = (q_0,\#,R)$, $\delta(q_0,\#) = (q_A,\mathbf{1},S)$

   h) $L = \{ w \in \{\mathbf{a}, \mathbf{b}, \mathbf{c}\}^* \mid N_{\mathbf{a}}(w) = N_{\mathbf{b}}(w) = N_{\mathbf{c}}(w) \}$
   $\delta(q_0,\mathbf{a}) = (q_1,\mathbf{d},L)$, $\delta(q_0,\mathbf{b}) = (q_0,\mathbf{b},R)$, $\delta(q_0,\mathbf{c}) = (q_0,\mathbf{c},R)$, $\delta(q_0,\mathbf{d}) = (q_0,\mathbf{d},R)$, $\delta(q_1,\boldsymbol{\sigma}) = (q_1,\boldsymbol{\sigma},L)$, $\delta(q_1,\#) = (q_2,\#,R)$, $\delta(q_2,\mathbf{a}) = (q_2,\mathbf{a},R)$, $\delta(q_2,\mathbf{b}) = (q_3,\mathbf{d},L)$, $\delta(q_2,\mathbf{c}) = (q_2,\mathbf{c},R)$, $\delta(q_2,\mathbf{d}) = (q_2,\mathbf{d},R)$, $\delta(q_3,\boldsymbol{\sigma}) = (q_3,\boldsymbol{\sigma},L)$, $\delta(q_3,\#) = (q_4,\#,R)$, $\delta(q_4,\mathbf{a}) = (q_4,\mathbf{a},R)$, $\delta(q_4,\mathbf{b}) = (q_4,\mathbf{b},R)$, $\delta(q_4,\mathbf{c}) = (q_5,\mathbf{d},L)$, $\delta(q_4,\mathbf{d}) = (q_4,\mathbf{d},R)$, $\delta(q_5,\boldsymbol{\sigma}) = (q_5,\boldsymbol{\sigma},L)$, $\delta(q_5,\#) = (q_0,\#,R)$, $\delta(q_0,\#) = (q_6,\#,L)$, $\delta(q_6,\mathbf{d}) = (q_6,\#,L)$, $\delta(q_6,\#) = (q_A,\mathbf{1},S)$

   i) $L = \{ \mathbf{a}^n\mathbf{b}^{2n} \mid n \geq 0 \}$
   $\delta(q_0,\mathbf{a}) = (q_1,\#,R)$, $\delta(q_1,\boldsymbol{\sigma}) = (q_1,\boldsymbol{\sigma},R)$, $\delta(q_1,\#) = (q_2,\#,L)$, $\delta(q_2,\mathbf{b}) = (q_3,\#,L)$, $\delta(q_3,\mathbf{b}) = (q_4,\#,L)$, $\delta(q_4,\boldsymbol{\sigma}) = (q_4,\boldsymbol{\sigma},L)$, $\delta(q_4,\#) = (q_0,\#,R)$, $\delta(q_0,\#) = (q_A,\mathbf{1},S)$

   j) $L = \{ \mathbf{a}^m\mathbf{b}^n\mathbf{a}^m\mathbf{b}^n \mid m, n > 0 \}$
   $\delta(q_0,\mathbf{a}) = (q_1,\#,R)$, $\delta(q_1,\mathbf{a}) = (q_1,\mathbf{a},R)$, $\delta(q_1,\mathbf{b}) = (q_2,\mathbf{b},R)$, $\delta(q_2,\mathbf{b}) = (q_2,\mathbf{b},R)$, $\delta(q_2,\mathbf{c}) = (q_2,\mathbf{c},R)$, $\delta(q_2,\mathbf{a}) = (q_3,\mathbf{c},L)$, $\delta(q_3,\boldsymbol{\sigma}) = (q_3,\boldsymbol{\sigma},L)$, $\delta(q_3,\#) = (q_4,\#,R)$, $\delta(q_4,\mathbf{a}) = (q_1,\#,R)$, $\delta(q_4,\mathbf{b}) = (q_5,\#,R)$, $\delta(q_5,\mathbf{b}) = (q_5,\mathbf{b},R)$, $\delta(q_5,\mathbf{c}) = (q_6,\mathbf{c},R)$, $\delta(q_6,\mathbf{c}) = (q_6,\mathbf{c},R)$, $\delta(q_6,\mathbf{b}) = (q_7,\mathbf{c},L)$, $\delta(q_7,\boldsymbol{\sigma}) = (q_7,\boldsymbol{\sigma},L)$, $\delta(q_7,\#) = (q_8,\#,R)$, $\delta(q_8,\mathbf{b}) = (q_5,\#,R)$, $\delta(q_8,\mathbf{c}) = (q_9,\#,R)$, $\delta(q_9,\mathbf{c}) = (q_9,\#,R)$, $\delta(q_9,\#) = (q_A,\mathbf{1},S)$