

Práctica - 1

Teoría de autómatas

1. Construir una gramática para el lenguaje $\{0^m 1^{2m} 2^{2n} \mid m > 0, n \geq 0\}$

$$G = (V, T, P, S)$$

$$V = \{S, A, B\}$$

$$T = \{0, 1, 2\}$$

$$P = \{S \rightarrow AB, A \rightarrow 0A11 \mid 011, B \rightarrow 22B \mid \lambda\}$$

2. Sea la gramática $G = (\{E, T, F\}, \{+, -, *, /, (,), i\}, E \rightarrow T \mid E+T \mid E-T, T \rightarrow F \mid T*F \mid T/F, F \rightarrow (E) \mid i, E)$. Obtener derivaciones de las siguientes sentencias: i , (i) , $i*i$, $i*i+i$, $i*(i+i)$.

$$E \rightarrow T \mid E+T \mid E-T$$

$$T \rightarrow F \mid T*F \mid T/F$$

$$F \rightarrow (E) \mid i$$

- i

$$E \rightarrow T \rightarrow F \rightarrow i$$

- (i)

$$E \rightarrow T \rightarrow F \rightarrow (E) \rightarrow (T) \rightarrow (F) \rightarrow (i)$$

- $i*i$

$$E \rightarrow T \rightarrow T*F \rightarrow F*F \rightarrow i*i$$

- $i*i+i$

$$E \rightarrow E+T \rightarrow E+F \rightarrow E+i \rightarrow T+i \rightarrow T*F+i \rightarrow F*F+i \rightarrow i*i+i$$

- $i*(i+i)$

$$E \rightarrow T \rightarrow T*F \rightarrow i*F \rightarrow i*(E) \rightarrow i*(E+T) \rightarrow i*(E+F) \rightarrow i*(E+i) \rightarrow i*(T+i) \rightarrow i*(T+i) \rightarrow i*(F+i) \rightarrow i*(i+i)$$

3. Dadas las siguientes gramáticas, definir el lenguaje descrito por cada una de ellas:

$$-G_1 = (\{S, A, B\}, \{c, d\}, \{S \rightarrow cA, A \rightarrow d \mid cA \mid Bd, B \rightarrow d \mid Bd\}, S)$$

$$L_1 = \{ c^m d^n \mid m, n > 0 \}$$

$$-G_2 = (\{S, A\}, \{c\}, \{S \rightarrow \lambda \mid A, A \rightarrow AcA \mid c\}, S)$$

$$L_2 = \{ c^n \mid n = 0 \mid n \text{ impar} \}$$

$$-G_3 = (\{S, A, B\}, \{c, 0\}, \{S \rightarrow AcA, A \rightarrow 0, Ac \rightarrow AACa \mid ABc \mid AcB, B \rightarrow A \mid AB\}, S)$$

$$L_3 = \{ 0^m c 0^n \mid m, n > 0 \}$$

4. Construir una gramática que genere cada uno de los lenguajes siguientes:

$$-L_1 = \{ 0^m 1^n \mid m \geq n \geq 0 \}$$

$$-L_2 = \{ 0^k 1^m 0^n \mid n = k + m \}$$

$$G = (V, T, P, S)$$

$$V = \{ S \}$$

$$T = \{ 0, 1 \}$$

$$P = \{ S \rightarrow 0S1 \mid 0S \mid \lambda \}$$

$$G = (V, T, P, S)$$

$$V = \{ S, B \}$$

$$T = \{ 0, 1 \}$$

$$P = \{ S \rightarrow 0S0 \mid B, B \rightarrow 1S0, \lambda \}$$

$$-L_3 = \{ w2w^{-1} \mid w \in \{ 0, 1 \}^* \}$$

$$-L_4 = \{ 10^n \mid n = 0, 1, 2, \dots \}$$

$$G = (V, T, P, S)$$

$$V = \{ S \}$$

$$T = \{ 0, 1 \}$$

$$P = \{ S \rightarrow 0S0 \mid 1S1 \mid 2 \}$$

$$G = (V, T, P, S)$$

$$V = \{ S \}$$

$$T = \{ 0, 1 \}$$

$$P = \{ S \rightarrow 1 \mid S0 \}$$

5. Limpiar la gramática $G=(\{0,1\},\{A, B, C, D, E, F\}, \{A \rightarrow AC \mid A1 \mid BCD \mid 0, B \rightarrow CB1 \mid 0F0, C \rightarrow C \mid ABD \mid AD \mid D0, D \rightarrow AC \mid BC \mid D \mid 1, E \rightarrow CD \mid BD \mid AC \mid E, F \rightarrow ABD1 \mid FB0 \mid B\}, A)$

$A \rightarrow AC \mid A1 \mid BCD \mid 0$ (BCD (Regla Superflua B))
 $B \rightarrow \cancel{CB1} \mid \cancel{0F0}$ (Regla Superflua)
 $C \rightarrow \epsilon \mid \cancel{ABD} \mid AD \mid D0$ (C Regla Inecesaria - ABD (Regla Superflua B))
 $D \rightarrow AC \mid \cancel{BC} \mid \cancel{D} \mid 1$ (D Regla Inecesaria - BC (Regla Superflua B))
 $E \rightarrow \cancel{CD} \mid \cancel{BD} \mid \cancel{AC} \mid \cancel{E}$ (E Regla Inecesaria - Símbolo Inaccesible)
 $F \rightarrow \cancel{ABD1} \mid \cancel{FB0} \mid \cancel{B}$ (Regla Superflua)

Gramática limpia:

$G = (V, T, P, A)$
 $V = \{A, C, D\}$
 $T = \{0, 1\}$
 $P = \{A \rightarrow AC \mid A1 \mid 0, C \rightarrow AD \mid D0, D \rightarrow AC \mid 1\}$

6. Limpiar la gramática: $G=(\{0, 1\}, \{S, A, B, C, D, E\}, \{S \rightarrow 0A \mid B \mid E, A \rightarrow 0 \mid A \mid 0A, B \rightarrow 0B \mid B, C \rightarrow A1 \mid E \mid 0, D \rightarrow 1C \mid E \mid A \mid 0B, E \rightarrow 0B1 \mid 1B0\}, S)$

$S \rightarrow 0A \mid B \mid E$ (B, E (Regla Superflua B))
 $A \rightarrow 0 \mid A \mid 0A$ (A Regla Inecesaria)
 $B \rightarrow \cancel{0B} \mid \cancel{B}$ (B Regla Inecesaria - Regla Superflua)
 $C \rightarrow \cancel{A1} \mid \cancel{E} \mid \cancel{0}$ (Símbolo Inaccesible)
 $D \rightarrow \cancel{1C} \mid \cancel{E} \mid \cancel{A} \mid \cancel{0B}$ (Símbolo Inaccesible)
 $E \rightarrow \cancel{0B1} \mid \cancel{1B0}$ (0B1, 1B0, E (Regla Superflua B))

Gramática limpia:

$G = (V, T, P, S)$
 $V = \{S, A\}$
 $T = \{0\}$
 $P = \{S \rightarrow 0A, A \rightarrow 0 \mid 0A\}$

7. Limpiar la gramática: $G = (\{0,1\}, \{S, A, B, C\}, \{S \rightarrow 0S0 \mid 0B1 \mid S \mid A \mid \lambda, A \rightarrow 1A1 \mid \lambda, B \rightarrow 0B1, C \rightarrow 0B \mid A0B1 \mid 0 \mid 1\}, S)$

$S \rightarrow 0S0 \mid 0B1 \mid S \mid A \mid \lambda$ (S Regla Inecesaria, $0B1$ (Regla Superflua B))
 $A \rightarrow 1A1 \mid \lambda$
 ~~$B \rightarrow 0B1$~~ (Regla Superflua)
 ~~$C \rightarrow 0B \mid A0B1 \mid 0 \mid 1$~~ (Símbolo Inaccesible)

Gramática limpia:

$G = (V, T, P, S)$
 $V = \{S, A\}$
 $T = \{0, 1\}$
 $P = \{S \rightarrow 0S0 \mid A \mid \lambda, A \rightarrow 1A1 \mid \lambda\}$

8. Limpiar la gramática: $G = (\{0,1\}, \{A, B, C, D, E, F\}, \{A \rightarrow A \mid AC \mid D, B \rightarrow A \mid D \mid 1, C \rightarrow EF \mid 1AFD \mid C, D \rightarrow AB \mid B \mid 01, E \rightarrow B \mid 1B \mid A, F \rightarrow 1F \mid 0C\}, A)$

$A \rightarrow A \mid AC \mid D$ (A Regla Inecesaria)
 $B \rightarrow A \mid D \mid 1$
 ~~$C \rightarrow EF \mid 1AFD \mid C$~~ (C Regla Inecesaria - Regla Superflua)
 $D \rightarrow AB \mid B \mid 01$
 $E \rightarrow B \mid 1B \mid A$
 ~~$F \rightarrow 1F \mid 0C$~~ (Regla Superflua)

Gramática limpia:

$G = (V, T, P, A)$
 $V = \{A, B, D, E\}$
 $T = \{0, 1\}$
 $P = \{A \rightarrow AC \mid D, B \rightarrow A \mid D \mid 1, D \rightarrow AB \mid B \mid 01, E \rightarrow B \mid 1B \mid A\}$

9. Limpiar la gramática: $G = (\{0,1\}, \{S, A, B, C, D, E\}, \{S \rightarrow 0A \mid B \mid E, A \rightarrow 0 \mid A \mid 0A, B \rightarrow 2B \mid B, C \rightarrow A1 \mid E \mid 2, D \rightarrow 1C \mid E \mid A \mid 0B, E \rightarrow 0B1 \mid 2E3\}, S)$

$S \rightarrow 0A \mid B \mid E$ (B (Regla Superflua B) - E (Regla Superflua E))
 $A \rightarrow 0 \mid A \mid 0A$ (A Regla Inecesaria)
 $B \rightarrow 2B \mid B$ (B Regla Inecesaria - Regla Superflua)
 $C \rightarrow A1 \mid E \mid 2$ (Símbolo Inaccesible)
 $D \rightarrow 1C \mid E \mid A \mid 0B$ (Símbolo Inaccesible)
 $E \rightarrow 0B1 \mid 2E3$ (0B1 (Regla Superflua B) - Regla Superflua)

Gramática limpia:

$G = (V, T, P, S)$
 $V = \{S, A\}$
 $T = \{0\}$
 $P = \{S \rightarrow 0A, A \rightarrow 0 \mid 0A\}$

10. Definir el lenguaje generado por la gramática: $G = (\{0, 1\}, \{A, B, C, S\}, \{S \rightarrow 0S0 \mid 0B1 \mid S \mid A \mid \lambda, A \rightarrow 1A1 \mid \lambda, B \rightarrow 0B1, C \rightarrow 0B \mid A0B1 \mid 0 \mid 1 \mid \lambda\}, S)$

$S \rightarrow 0S0 \mid 0B1 \mid S \mid A \mid \lambda$ (S Regla Inecesaria - 0B1 Regla superflua)
 $A \rightarrow 1A1 \mid \lambda$
 $B \rightarrow 0B1$ (Regla superflua)
 $C \rightarrow 0B \mid A0B1 \mid 0 \mid 1 \mid \lambda$ (Símbolo Inaccesible)

Gramática limpia:

$G = (V, T, P, S)$
 $V = \{S, A\}$
 $T = \{0, 1\}$
 $P = \{S \rightarrow 0S0 \mid A \mid \lambda, A \rightarrow 1A1 \mid \lambda\}$ Lenguaje generado:

$$-L = \{ 0^n 1^m 1^m 0^n \mid n, m \geq 0 \}$$

11. Definir el lenguaje generado por la gramática: $G = (\{0, 1\}, \{A, B, C, S\}, \{S \rightarrow 00S11 \mid A0 \mid 1B1 \mid D0A \mid 1, A \rightarrow AB0 \mid A0 \mid D1, D \rightarrow 0D \mid 0A\}, S)$

$S \rightarrow 00S11 \mid A0 \mid 1B1 \mid D0A \mid 1$ ($1B1$ B no existe y todas son reglas superfluas)
 $A \rightarrow AB0 \mid A0 \mid D1$
 $D \rightarrow 0D \mid 0A$

12. Describe la gramática generadora de $L(G) = 0^{3n+1}1^{3n+1}$

$G = (V, T, P, S)$
 $V = \{S\}$
 $T = \{0, 1\}$
 $P = \{s \rightarrow 01 \mid 000S111\}$

13. Describe la gramática generadora de $L(G) = \{a^i b^j c^m \mid i=2n \text{ para } n>0, j=3m, m \geq 0\}$

$G = (V, T, P, S)$
 $V = \{S\}$
 $T = \{a, b, c\}$
 $P = \{A \rightarrow AC \mid D, B \rightarrow A \mid D \mid 1, D \rightarrow AB \mid B \mid 01, E \rightarrow B \mid 1B \mid A\}$

14. Describe el lenguaje generado por la gramática: $G = (\{S\}, \{0,1\}, \{S \rightarrow 00S11 \mid 1\}, S)$

$-L = \{0^n 1^m 1^m \mid n, m \geq 0\}$