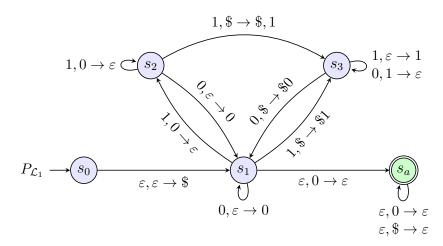
PDA - autômatos com pilha:

Linguagens definidas sobre o alfabeto $\Sigma = \{0, 1\}$:

$$\mathcal{L}_1 = \{ w \in \Sigma^* \mid |w|_0 > |w|_1 \}.$$

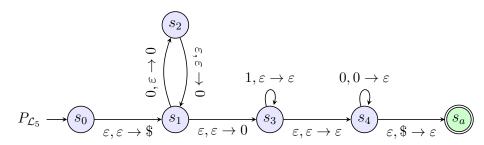


$$\mathcal{L}_2 = \{ w \in \Sigma^* \mid w = 0u0 \text{ ou } w = 1u1, |w|_0 = |w|_1, u \in \Sigma^+ \}.$$

$$\mathcal{L}_3 = \{ w \in \Sigma^* \mid w \neq 0^n 1^m, \ m, n \in \mathbb{N}, \ n = 2m \text{ ou } m = 2n \}.$$

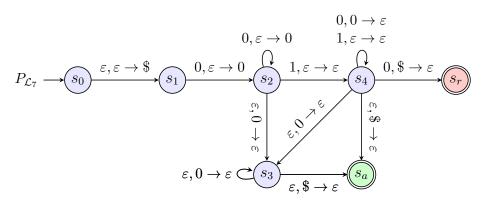
$$\mathcal{L}_4 = \{ w \in \Sigma^* \mid w = 0^n 10^n, \ n \in \mathbb{N} \}.$$

$$\mathcal{L}_5 = \{ w \in \Sigma^* \mid w = 0^n 1^m 0^{2n}, m, n \geqslant 0 \}.$$

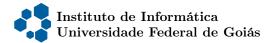


$$\mathcal{L}_6 = \{ w \in \Sigma^* \mid w = 0^{2n} 1^{3n} 0^m, m, n \in \mathbb{N}, \}.$$

$$\mathcal{L}_7 = \{ w \in \Sigma^* \mid w = 0^n u, u \in \Sigma^*, n \in \mathbb{N}^+, |u|_0 \leqslant n \}.$$



$$\mathcal{L}_8 = \{ w \in \Sigma^* \mid w = 0^n 1^m, m, n \in \mathbb{N}, m > n + 2 \}.$$



$$\mathcal{L}_9 = \{ w \in \Sigma^* \mid w = u(\overline{u})^R, \ u \in \Sigma^* \}.$$

O sufixo \overline{u} é obtido com a troca dos símbolos de u,ou seja, $0\leftrightarrow 1.$

$$0, \varepsilon \to 0 \qquad 0, 1 \to \varepsilon$$

$$1, \varepsilon \to 1 \qquad 1, 0 \to \varepsilon$$

$$P_{\mathcal{L}_{9}} \longrightarrow \underbrace{s_{0}} \quad \varepsilon, \varepsilon \to \$ \qquad \underbrace{s_{1}} \quad \varepsilon, \varepsilon \to \varepsilon \qquad \underbrace{s_{2}} \quad \varepsilon, \$ \to \varepsilon \qquad \underbrace{s_{a}} \quad \underbrace{s_{$$

$$\mathcal{L}_{10} = \{ w \in \Sigma^* \mid w = uuu, u \in \Sigma^* \}.$$

$$\mathcal{L}_{11} = \{ w \in \Sigma^* \mid w = uu^R v, u, v \in \Sigma^+ \}.$$

$$\mathcal{L}_{12} = \{ w \in \Sigma^* \mid w = uv, u, v \in \Sigma^+, |u|_1 < |v|_0 \}.$$

$$0, \varepsilon \to \varepsilon \qquad 0, 1 \to \varepsilon \qquad 0, \varepsilon \to \varepsilon$$

$$1, \varepsilon \to 1 \qquad 1, \varepsilon \to \varepsilon \qquad 1, \varepsilon \to \varepsilon$$

$$P_{\mathcal{L}_{12}} \longrightarrow \underbrace{s_0} \qquad \underbrace{\varepsilon, \varepsilon \to \$} \qquad \underbrace{s_1} \qquad \underbrace{\varepsilon, \varepsilon \to \varepsilon} \qquad \underbrace{s_2} \qquad \underbrace{s_2} \qquad \underbrace{s_3} \qquad \underbrace{s_4} \qquad \underbrace{s_4} \qquad \underbrace{s_5} \qquad$$

$$\mathcal{L}_{13} = \{ w \in \Sigma^* \mid w = w^R \in |w| \text{ \'e par} \}.$$

$$0, \varepsilon \to 0 \qquad 0, 0 \to \varepsilon$$

$$1, \varepsilon \to 1 \qquad 1, 1 \to \varepsilon$$

$$P_{\mathcal{L}_{13}} \longrightarrow \underbrace{s_0} \xrightarrow{\varepsilon, \varepsilon \to \$} \underbrace{s_1} \xrightarrow{\varepsilon, \varepsilon \to \varepsilon} \underbrace{s_2} \xrightarrow{\varepsilon, \$ \to \varepsilon} \underbrace{s_a}$$

$$\mathcal{L}_{14} = \{ w \in \Sigma^* \mid w = (01)^n (10)^n, \ n \in \mathbb{N} \}.$$

$$\mathcal{L}_{15} = \{ w \in \Sigma^* \mid w = (0^{i_n} 1^{i_n})^n, n \in \mathbb{N} \text{ e } i_n \in \mathbb{N}, \ \forall \ i_n \}$$

$$\mathcal{L}_{16} = \{ w \in \Sigma^* \mid w = 0^m 1^n 0^p, \ m, n, p \in \mathbb{N}^+, \ m+n = p \}.$$

$$0, \varepsilon \to X \qquad 1, \varepsilon \to X \qquad 0, X \to \varepsilon$$

$$P_{\mathcal{L}_{16}} \longrightarrow \underbrace{s_0} \xrightarrow{\varepsilon, \varepsilon \to \$} \underbrace{s_1} \xrightarrow{0, \varepsilon \to X} \underbrace{s_2} \xrightarrow{1, \varepsilon \to X} \underbrace{s_3} \xrightarrow{0, X \to \varepsilon} \underbrace{s_4} \xrightarrow{\varepsilon, \$ \to \varepsilon} \underbrace{s_5} \underbrace{s_5} \xrightarrow{\varepsilon, \$ \to \varepsilon} \underbrace{s_5} \underbrace{s_5} \xrightarrow{\varepsilon, \$ \to \varepsilon} \underbrace{s_5} \underbrace{s_5}$$

$$\mathcal{L}_{17} = \{ w \in \Sigma^* \mid w = 0^m 1^n 0^p, m, n, p \in \mathbb{N}^+, p = m - n \}.$$

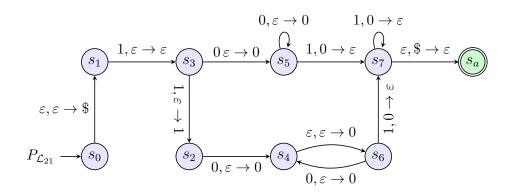
$$P_{\mathcal{L}_{17}} \longrightarrow \underbrace{\begin{pmatrix} s_0 \end{pmatrix}}_{\varepsilon, \varepsilon \to \$} \underbrace{\begin{pmatrix} s_1 \end{pmatrix}}_{0, \varepsilon \to X} \underbrace{\begin{pmatrix} s_1 \end{pmatrix}}_{0, \varepsilon \to X} \underbrace{\begin{pmatrix} s_2 \end{pmatrix}}_{1, X \to \varepsilon} \underbrace{\begin{pmatrix} s_1 \end{pmatrix}}_{0, X \to \varepsilon} \underbrace{\begin{pmatrix} s_1 \end{pmatrix}}_{0, X \to \varepsilon} \underbrace{\begin{pmatrix} s_2 \end{pmatrix}}_{0, X \to \varepsilon} \underbrace{\begin{pmatrix} s_1 \end{pmatrix}}_{0, x \to \varepsilon} \underbrace{\begin{pmatrix} s_2 \end{pmatrix}}_{0, x \to \varepsilon} \underbrace{\begin{pmatrix} s_1 \end{pmatrix}}_{0, x \to \varepsilon} \underbrace{\begin{pmatrix} s_2 \end{pmatrix}}_{0, x \to \varepsilon} \underbrace{\begin{pmatrix} s_1 \end{pmatrix}}_{0, x \to \varepsilon} \underbrace{\begin{pmatrix} s_2 \end{pmatrix}}_{0, x \to \varepsilon} \underbrace{\begin{pmatrix}$$

$$\mathcal{L}_{18} = \{ w \in \Sigma^* \mid w = 0^m 1^n 0^p, m, n, p \in \mathbb{N}^+, m + p = n \}.$$

$$\mathcal{L}_{19} = \{ w \in \Sigma^* \mid w = 0^m 1^n 2^p, \ m, n, p \in \mathbb{N}, ((m \le n) \text{ ou } (m > n)) \in m \ne p \}.$$

$$\mathcal{L}_{20} = \{ w \in \Sigma^* \mid w = 0^n 1^m 0^m, m, n \in \mathbb{N} \}.$$

$$\mathcal{L}_{21} = \{ w \in \Sigma^* \mid w = 10^n 1^n \text{ ou } w = 110^n 1^{2n} \ n \in \mathbb{N}^+ \}.$$



$$\mathcal{L}_{22} = \{ w \in \Sigma^* \mid w = 0^n 1^n 1^m 0^m, \ m, n \in \mathbb{N} \}.$$

$$P_{\mathcal{L}_{22}} \xrightarrow{\varepsilon, \varepsilon \to \$} \underbrace{s_1} \xrightarrow{\varepsilon, \varepsilon \to \varepsilon} \underbrace{s_2} \xrightarrow{\varepsilon, \varepsilon \to \varepsilon} \underbrace{s_3} \xrightarrow{\varepsilon, \varepsilon \to \varepsilon} \underbrace{s_4} \xrightarrow{\varepsilon, \$ \to \varepsilon} \underbrace{s_5} \underbrace{s_5} \xrightarrow{\varepsilon, \$ \to \varepsilon} \underbrace{s_5} \underbrace{s_5} \xrightarrow{\varepsilon, \$ \to \varepsilon} \underbrace{s_5} \underbrace{s_5}$$

$$\mathcal{L}_{23} = \{ w \in \Sigma^* \mid w = 0^n 1^m 0^p 1^q, \ m, n, p, q \in \mathbb{N}, \ m+n = p+q \}.$$

$$0, \varepsilon \to X \qquad 1, \varepsilon \to X \qquad 0, X \to \varepsilon \qquad 1, X \to \varepsilon$$

$$P_{\mathcal{L}_{23}} \longrightarrow \underbrace{\begin{pmatrix} s_0 & \varepsilon, \varepsilon \to \varepsilon & \varepsilon \\ s_1 & \varepsilon, \varepsilon \to \varepsilon \\ s_2 & \varepsilon, \varepsilon \to \varepsilon \end{pmatrix}}_{s_1} \underbrace{\begin{pmatrix} s_1 & \varepsilon, \varepsilon \to \varepsilon \\ s_2 & \varepsilon, \varepsilon \to \varepsilon \\ s_3 & \varepsilon, \varepsilon \to \varepsilon \end{pmatrix}}_{s_3} \underbrace{\begin{pmatrix} s_2 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \end{pmatrix}}_{s_4} \underbrace{\begin{pmatrix} s_2 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \end{pmatrix}}_{s_4} \underbrace{\begin{pmatrix} s_2 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \end{pmatrix}}_{s_4} \underbrace{\begin{pmatrix} s_2 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \end{pmatrix}}_{s_4} \underbrace{\begin{pmatrix} s_2 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \end{pmatrix}}_{s_4} \underbrace{\begin{pmatrix} s_2 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \end{pmatrix}}_{s_4} \underbrace{\begin{pmatrix} s_2 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \end{pmatrix}}_{s_4} \underbrace{\begin{pmatrix} s_2 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \end{pmatrix}}_{s_4} \underbrace{\begin{pmatrix} s_2 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \end{pmatrix}}_{s_4} \underbrace{\begin{pmatrix} s_2 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \end{pmatrix}}_{s_4} \underbrace{\begin{pmatrix} s_2 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \end{pmatrix}}_{s_4} \underbrace{\begin{pmatrix} s_2 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \end{pmatrix}}_{s_4} \underbrace{\begin{pmatrix} s_2 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \end{pmatrix}}_{s_4} \underbrace{\begin{pmatrix} s_2 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \end{pmatrix}}_{s_5} \underbrace{\begin{pmatrix} s_2 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \\ s_5 & \varepsilon, \varepsilon \to \varepsilon \end{pmatrix}}_{s_5} \underbrace{\begin{pmatrix} s_2 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \\ s_5 & \varepsilon, \varepsilon \to \varepsilon \end{pmatrix}}_{s_5} \underbrace{\begin{pmatrix} s_2 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \\ s_5 & \varepsilon, \varepsilon \to \varepsilon \end{pmatrix}}_{s_5} \underbrace{\begin{pmatrix} s_2 & \varepsilon, \varepsilon \to \varepsilon \\ s_4 & \varepsilon, \varepsilon \to \varepsilon \\ s_5 & \varepsilon, \varepsilon \to \varepsilon \end{pmatrix}}_{s_5} \underbrace{\begin{pmatrix} s_2 & \varepsilon, \varepsilon \to \varepsilon \\ s_5 & \varepsilon, \varepsilon \to \varepsilon \\ s_5 & \varepsilon, \varepsilon \to \varepsilon \end{pmatrix}}_{s_5} \underbrace{\begin{pmatrix} s_2 & \varepsilon, \varepsilon \to \varepsilon \\ s_5 & \varepsilon, \varepsilon$$

$$\mathcal{L}_{24} = \{ w \in \Sigma^* \mid w = 0^n 1^m 0^p 1^q, m, n, p, q \in \mathbb{N}, n > m, p < q \}$$

$$\mathcal{L}_{25} = \{ w \in \Sigma^* \mid w = 0^n 1^{2m} 0^m 1^{2n} \ m, n \in \mathbb{N} \}.$$

$$\mathcal{L}_{26} = \{ w \in \Sigma^* \mid w = u^n, \ 2 \leqslant n \in \mathbb{N}, \ u \in \Sigma^* \}.$$

Linguagens definidas sobre o alfabeto $\Sigma = \{0, 1, \#\}$:

$$\mathcal{L}_{27} = \{ w \in \Sigma^* \mid w = x \# y, \ x, y \in \{0, 1\}^* \ e \ x^R \neq y \}.$$

$$\mathcal{L}_{28} = \{ w \in \Sigma^* \mid w = x \# y, \ x, y \in \{0, 1\}^*, \ y \neq x^R \ e \ |x| = |y| \}.$$

$$\mathcal{L}_{29} = \{ w \in \Sigma^* \mid w = x \# y \# z, \ x, y, z \in \{0, 1\}^*, \ |z|_0 = 2 \cdot |y|_1 \text{ e } |x| = 2 \cdot k, \ k \in \mathbb{N} \}.$$

$$\mathcal{L}_{30} = \{ w \in \Sigma^* \mid w = x \# y, \ x, y \in \{0, 1\}^* \ e \ |x|_0 = |y|_1 \}.$$

$$0, \varepsilon \to 0 \qquad 0, \varepsilon \to \varepsilon$$

$$1, \varepsilon \to \varepsilon \qquad 1, 0 \to \varepsilon$$

$$P_{\mathcal{L}_{30}} \longrightarrow \underbrace{s_0} \qquad \underbrace{\varepsilon, \varepsilon \to \$} \qquad \underbrace{s_1} \qquad \underbrace{\#, \varepsilon \to \varepsilon} \qquad \underbrace{s_2} \qquad \underbrace{\varepsilon, \$ \to \varepsilon} \qquad \underbrace{s_a}$$

$$\mathcal{L}_{31} = \{ w \in \Sigma^* \mid w = u \# 0^{|u|_0}, \ u \in \{0, 1\}^* \}.$$

Linguagens extras definidas sobre o alfabeto $\Sigma = \{0, 1, \#\}$:

$$\mathcal{L}_{32} = \{ w \in \Sigma^* \mid w = 10^n 10^n 1, \ n \in \mathbb{N} \}.$$

$$P_{\mathcal{L}_{32}} \xrightarrow{\varepsilon, \varepsilon \to \$} \underbrace{s_1} \xrightarrow{1, \varepsilon \to \varepsilon} \underbrace{s_2} \xrightarrow{1, \varepsilon \to \varepsilon} \underbrace{s_3} \xrightarrow{1, \varepsilon \to \varepsilon} \underbrace{s_4} \xrightarrow{\varepsilon, \$ \to \varepsilon} \underbrace{s_a}$$

$$\mathcal{L}_{33} = \{ w \in \Sigma^* \mid w = 0^m 1^n u, u \in \{0, 1\}^*, m, n \in \mathbb{N}, |u| = m + n \}.$$

$$\mathcal{L}_{34} = \{ w \in \Sigma^* \mid w = 0^m 1^{m+n} 0^n, m, n \in \mathbb{N} \}.$$

$$\mathcal{L}_{35} = \{ w \in \Sigma^* \mid w = 0^{2m} 1^n 0^{2n}, m \in \mathbb{N}^+, n \in \mathbb{N} \}.$$

$$\mathcal{L}_{36} = \{ w \in \Sigma^* \mid w = 0^m 1^n 0^{2m} 0^p, m, n, p \in \mathbb{N} \}.$$

$$\mathcal{L}_{37} = \{ w \in \Sigma^* \mid w = 0^{3m+n} 1^n 0^3 1^m, \ m, n \in \mathbb{N} \}.$$

$$\mathcal{L}_{38} = \{ w \in \Sigma^* \mid w = u \# v \# u^R, \ u, v \in \{0, 1\}^+ \}.$$

$$\mathcal{L}_{39} = \{ w \in \Sigma^* \mid w = uv, u, v \in \{0, 1\}^*, |u| = |v|, u \neq v \}.$$

$$\mathcal{L}_{40} = \{ w \in \Sigma^* \mid w = 0^n 1^k, \ 1 \leqslant n \leqslant 2k \}$$