1) $\Sigma = \{\square\}$

$z = \square\square \rightarrow |z| = 2$

$zz = \square\square\square\square \rightarrow |zz| = 4$

$z^3 = zzz = \square\square\square\square\square\square \rightarrow |z^3| = 6$

$z^0 = \varepsilon \rightarrow |z^0| = 0$

$\Sigma^* = \{\varepsilon, \square, \square\square, \square\square\square \ldots$

2) $\Gamma = \{0,1\}$ $x = 01$ $y = 110$

$xy = ?$ $xy = \{01110\}$

$xyx = ?$ $xyx = \{0111001\}$

$(xy)^2 ?$ $(xy)^2 = xy.xy = \{01110.01110\}$

$(yxx)^0 =$ $(yxx)^0 = \{\varepsilon\}$

$\Gamma^2 = \{0,1\}\{0,1\} = \{00\ 01\ 10\ 11\}$

$\Gamma^* = \{\varepsilon, 0, 1, 00, 01, 10, 11, 000, \ldots$

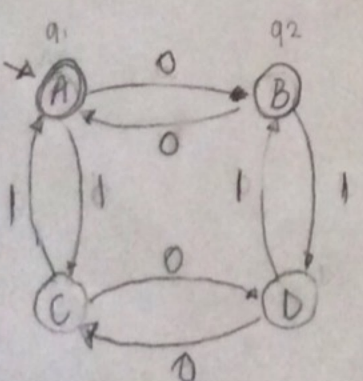
$\Gamma^+ = \Gamma^* - \{\varepsilon\}$

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

P: $S \rightarrow aSbScS \mid bScSaS \mid cSaSbS \mid aScSbS \mid \varepsilon$

É uma GLC tipo 2

4)



w = abab ✓

w = abba

$A \rightarrow 0B \mid 1C \mid \varepsilon$

$B \rightarrow 0A \mid 1D$

$C \rightarrow 0D \mid 1A$

$D \rightarrow 0C \mid 1B$

$q_1 \rightarrow a q_2$ $q_2 \rightarrow b q_4$ $q_3 \rightarrow a q_4$

$q_1 \rightarrow b q_3$ $q_2 \rightarrow a q_1$ $q_3 \rightarrow b q_1$

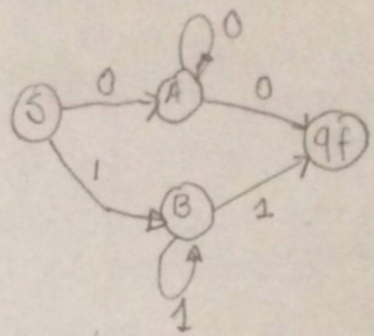
$q_4 \rightarrow b q_2$ $q_4 \rightarrow a q_3$

$L = \{0011, 0101 \ldots\}$

5.a

$S \rightarrow 0A$ $A \rightarrow 0A$ $B \rightarrow 1B$

$S \rightarrow 1B$ $A \rightarrow 0$ $B \rightarrow 1$

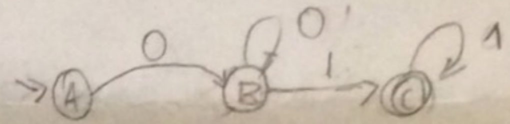


É um L.R

$L = \{w \in \{0,1\}$ / empieza com 1 e termina com 1 ou empieza com 0 e termina com 0

7.a

$L_1 = 0.1 = \{0^n 1^m / n, m > 0\}$



$L = \{01, 00111, \ldots$

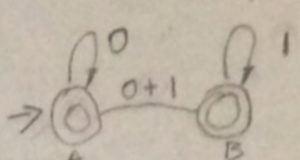
$A \rightarrow 0B$ $B \rightarrow 0B \mid 1C$

$C \rightarrow 1C$

7 b

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

$L = \{\varepsilon, 0, 1, 00, 01, 11 \ldots$



$A \rightarrow 0A \mid 1B \mid 0 \mid 1 \mid \varepsilon$

$B \rightarrow 1B \mid 1 \mid \varepsilon$

7.c $L = \{(01)^n / n > 0\}$

$S \rightarrow 01S \mid 01$

6) $L = \{ a^n b^m c^n \mid n, m \geq 0 \}$

$S \Rightarrow aSc \mid aAc \mid A \mid \varepsilon$
$A \Rightarrow bA \mid b$

8) $L = \{ w \mid w \in \{(,)\}^* \}$ e w esta balanceada

$S \Rightarrow (S) \mid SR \mid RS \mid \varepsilon$
$R \Rightarrow (R) \mid \varepsilon$

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

$A \to uB$
$A \Rightarrow u$

Mostrar q $L(G)$ é regular

Prova por inducção

É suficiente mostrar que existe um Automato que reconhesca ja que se L é regular existe um AF.

$M = (Q, \Sigma, \delta, q_0, F)$

$Q = V$ — δ é gerada de acordo as produções
$\Sigma = T$
$q_0 = S$
$F = \{q_F\}$

$A \to \varepsilon$	$\delta(A, \varepsilon) = q_F$
$A \to u$	$\delta(A, u) = q_F$
$A \to uB$	$\delta(A, u) = B$
$A \to B$	$\delta(A, \varepsilon) = B$

Base Indução

Ja que:
$L(G) = \{ w \in T^* \mid S \stackrel{+}{\Rightarrow} w \}$

Suponha nº derivações
$S \stackrel{1}{\Rightarrow} \alpha$ — $\alpha \in (V \cup T)^*$, $w \in T^*$

existe:
- Se $\alpha = \varepsilon$, $\exists\, S \to \varepsilon \Rightarrow \delta(S, \varepsilon) = q_F$
- Se $\alpha = u$, $\exists\, S \to u \Rightarrow \delta(S, u) = q_F$
- Se $\alpha = A$, $\exists\, S \to A \Rightarrow \delta(S, \varepsilon) = A$
- Se $\alpha = uA$ $\exists\, S \to uA \Rightarrow \delta(S, u) = A$

Hipotesis

Suponha $S \stackrel{n}{\Rightarrow} \alpha$ $n > 1$ / se:

b.1 Se $\alpha = w \Rightarrow \hat{\delta}(S, w) = \underline{q_F}$
b.2 Se $\alpha = \underset{T \neq 1}{wA} \Rightarrow \boxed{\hat{\delta}(S, w) = A}$

Passo Indução:

Suponha que $S \stackrel{n+1}{\Rightarrow} \alpha$, obrigatoriamente ocorre somente a hipotesis b.2

$S \stackrel{n}{\Rightarrow} wA \stackrel{1}{\Rightarrow} \alpha$

então α pode:

* Se $\alpha = w\varepsilon = w$ $\exists$ $A \to \varepsilon$:
$\boxed{\hat{\delta}(S, \underset{w.a}{w\varepsilon}) = \delta(\underset{A}{\hat{\delta}(S, w)}, \varepsilon) = \delta(A, \varepsilon) = q_F}$

* Se $\alpha = w\underline{b}$, $\exists$ $\underline{A \to b}$
$\hat{\delta}(S, \underline{wb}) = \delta(\hat{\delta}(S, w), b) = \delta(A, b) = \underline{q_F}$

* Se $\alpha = \underline{wbB}$, $\exists$ $A \to bB$
$\hat{\delta}(S, \underline{wb}) = \delta(\hat{\delta}(S, w), b) = \delta(A, b) = \underline{B}$

1a. $L = \{ww \mid w \in (0,1)^+\}$

$$\left.\begin{array}{lll} S \Rightarrow XY & & \\ X \rightarrow X0A \mid X1B \mid F & & \\ A0 \rightarrow 0A & F0 \rightarrow 0F & FY \rightarrow \varepsilon \\ A1 \rightarrow 1A & F1 \rightarrow 1F & X \Rightarrow \varepsilon \\ B0 \rightarrow 0B & AY \Rightarrow Y0 & Y \Rightarrow \varepsilon \\ B1 \rightarrow 1B & BY \Rightarrow Y1 & \end{array}\right\} \text{Gramatica Irrestrita}$$

$W.W = 0101$

$$S \Rightarrow XY \Rightarrow X1BY \Rightarrow X1Y1 \Rightarrow X0A1Y1 \Rightarrow X01AY1 \Rightarrow X01Y01$$

$$\varepsilon 01 \varepsilon 01$$

$$0101 \quad //$$