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Questão 1)

Dada as linguagens:

$L = \{00, 10, 111\}$

$M = \{\varepsilon, 001\}$

OPERAÇÕES:

1- $L \cup M = \{00, 10, 111\} \cup \{\varepsilon, 001\}$

$\therefore L \cup M = \{\varepsilon, 001, 10, 111\}$

2- $LM = \{00, 10, 111\}\{\varepsilon, 001\}$

$=$

$\therefore LM = \{00, 10, 111, 00001, 10001, 111001\}$

3- $L^2 = \{00, 10, 111\}^2$

$\therefore L^2 = \{0000, 0010, 00111,$
$10001, 1010, 10111,$
$11100, 11110, 111111\}$

$\Rightarrow L \cup M = \{\varepsilon, 001, 10, 111\}$

$\Rightarrow LM = \{00, 10, 111, 00001, 10001, 111001\}$

$\Rightarrow L^2 = \{0000, 0010, 00111, 10001, 1010, 10111, 11100, 11110, 111111\}$

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Questão 2)

Expressão regular para o conjunto de strings:

Para as sequências:

$01 \Rightarrow (01)^*$

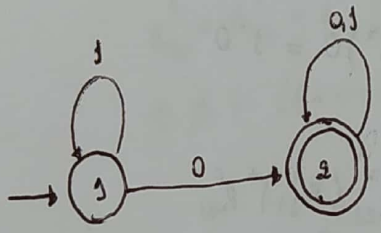
$10 \Rightarrow (10)^*$

Como é uma expressão regular alternada entre 1 e 0 $\Rightarrow 1(01)^*$ e $0(10)^*$

Assim:

RE: $(01)^* + (10)^* + 0(10)^* + 1(01)^*$

Questão 3)



Para $K = 0 \Rightarrow$

$R_{11}^{(0)}$	$\varepsilon + 1$
$R_{12}^{(0)}$	0
$R_{21}^{(0)}$	$\emptyset$
$R_{22}^{(0)}$	$(\varepsilon + 0 + 1)$

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Questão 3) - Continuação

Para: $K=3$;
$i=1$;
$j=1$;

$$R_{11}^{(1)} = R_{11}^{(0)} + R_{11}^{(0)}(R_{11}^{(0)})^{*}R_{11}^{(0)}$$

$$\Rightarrow (\varepsilon+1)+(\varepsilon+1)((\varepsilon+1))^{*}(\varepsilon+1)$$

$$\ldots (\varepsilon+1)+(\varepsilon+1)(\varepsilon+1)^{+} \Rightarrow (\varepsilon+1)(\varepsilon+(\varepsilon+1)^{+})$$

$$\Rightarrow (\varepsilon+1)(\varepsilon+1)^{*} \Rightarrow (\varepsilon+1)^{+} \Rightarrow 1^{*}$$

$$\Rightarrow \{\varepsilon, 1, 11, 111, \ldots\} = 1^{*}$$

Para $K=1$;
$j=2$;
$i=1$;

$$R_{12}^{1} = R_{12}^{0} + R_{11}^{0}(R_{11}^{0})^{*}R_{12}^{0}$$

$$\Rightarrow 0+(\varepsilon+1)(\varepsilon+1)^{*}0 = (0+(\varepsilon+1)^{+}0)$$

$$\Rightarrow (\varepsilon+1^{*})0 = 1^{*}0$$

Para $K=1$;
$j=1$;
$i=2$;

$$R_{21}^{1} = R_{21}^{0} + R_{21}^{0}(R_{11}^{0})^{*}R_{11}^{0}$$

$$\Rightarrow \emptyset(\varepsilon+1)^{*}(\varepsilon+1) = \emptyset$$

Para $K=1$;
$i=2$;
$j=2$;

$$R_{22}^{1} = R_{22}^{0} + R_{21}^{0}(R_{11}^{0})^{*}R_{12}^{0}$$

$$\Rightarrow (\varepsilon+0+1) + \emptyset(\varepsilon+1)^{*}0$$

$$\Rightarrow (\varepsilon+0+1)$$

R_{11}^{1}	1^{*}
R_{12}^{1}	$1^{*}0$
~~R_{11}^{1}~~	
R_{21}^{1}	$\emptyset$
R_{22}^{1}	$\varepsilon+0+1$

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3) - Continuação

Para $K=2$; $i=1$; $j=1$;

$$R_{11}^2 = R_{11}^1 + R_{12}^1 (R_{22}^1)^* R_{21}^1$$

$$\Rightarrow 1^* + 1^* 0 (\varepsilon + 0 + 1)^* \phi = 1^*$$

Para $K=2$; $i=1$; $j=2$

$$R_{12}^2 = R_{12}^1 + R_{12}^1 (R_{22}^1)^* R_{22}^2$$

$$\Rightarrow 1^* 0 + 1^* 0 (\varepsilon + 0 + 1)^* (\varepsilon + 0 + 1) \Rightarrow$$

$$\Rightarrow 1^* 0 + 1^* 0 (\varepsilon + 0 + 1)^+ \Rightarrow 1^* 0 (\varepsilon + (\varepsilon + 0 + 1)^+)$$

$$\Rightarrow 1^* 0 (0+1)^*$$

Para $K=2$; $i=2$; $j=1$

$$R_{21}^2 = R_{21}^1 + R_{22}^1 (R_{22}^1)^* R_{21}^1 \Rightarrow$$

$$\Rightarrow \phi + (\varepsilon + 0 + 1)(\varepsilon + 0 + 1)^* \phi \Rightarrow \phi$$

Para $K=2$; $i=2$; $j=2$

$$R_{22}^2 = R_{22}^1 + R_{22}^1 (R_{22}^1)^* R_{22}^1$$

$$\Rightarrow (\varepsilon + 0 + 1) + (\varepsilon + 0 + 1)(\varepsilon + 0 + 1)^* (\varepsilon + 0 + 1) \Rightarrow$$

$$\Rightarrow (\varepsilon + 0 + 1) + (\varepsilon + 0 + 1)(\varepsilon + 0 + 1)^+ \Rightarrow$$

$$\Rightarrow (\varepsilon + 0 + 1)(\varepsilon + (\varepsilon + 0 + 1)^+) \Rightarrow$$

$$\Rightarrow (\varepsilon + 0 + 1)(\varepsilon + 0 + 1)^* \Rightarrow (\varepsilon + 0 + 1)^+ \Rightarrow (0+1)^*$$

R_{11}^2	1^*
R_{12}^2	$1^* 0 (0+1)^*$
R_{21}^2	ϕ
R_{22}^2	$(0+1)^*$

$\therefore 1^* 0 (0+1)^*$

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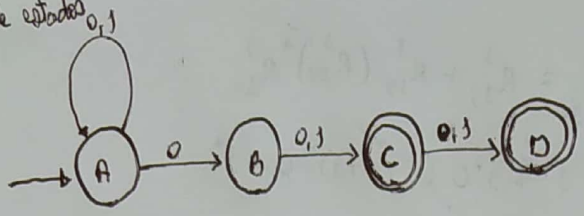
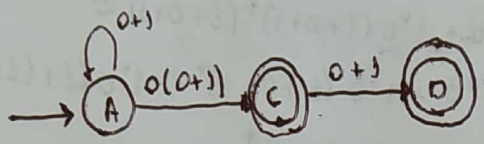
Questão 4) Eliminação de estados



- Estado B:

$Q = 0;\ S = \phi;\ P = 0+1;\ R = \phi$

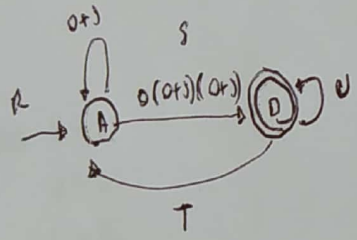
$R + QS^*P = \phi + 0\phi^*(0+1) \Rightarrow \phi + 0(0+1) \Rightarrow 0(0+1)$



- Estado C:

$Q = 0(0+1);\ S = \phi;\ P = 0+1;\ R = \phi$

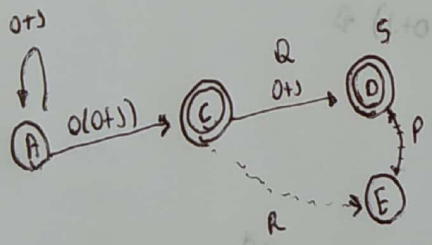
$R + QS^*P = \phi + (0(0+1))\,\phi^*(0+1) \Rightarrow 0(0+1)(0+1)$



$R = 0+1;\ S = 0(0+1)(0+1);\ U = \phi;\ T = \phi$

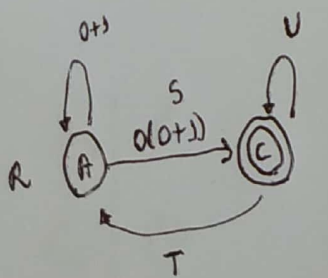
$(R + SU^*T)^*SU^* = ((0+1) + (0(0+1)(0+1))\,\phi^*\phi)^*(0(0+1)(0+1)\,\phi^*)$

$\Rightarrow ((0+1)+\phi)^*(0(0+1)(0+1)) \Rightarrow (0+1)^*(0(0+1)(0+1)) = E_1$



$R = \phi;\ S = \phi;\ P = \phi;\ Q = 0+1$

$R + QS^*P = \phi + (0+1)\,\phi^*\phi \Rightarrow \phi$



$R = 0+1;\ S = 0(0+1);\ U = \phi;\ T = \phi$

$(R + SU^* + T)^*SU^* = (0+1) + (0(0+1))\,\phi^*\phi)^*0(0+1)\phi^* \Rightarrow (0+1)^*0(0+1) = E_2$

$E_T = E_1 + E_2 = (0+1)^*(0(0+1)(0+1)) + (0+1)^*0(0+1)$

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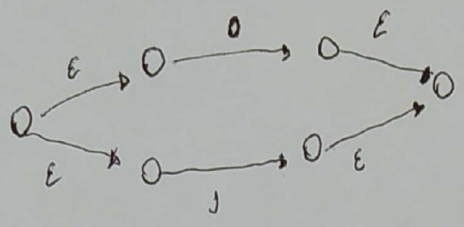
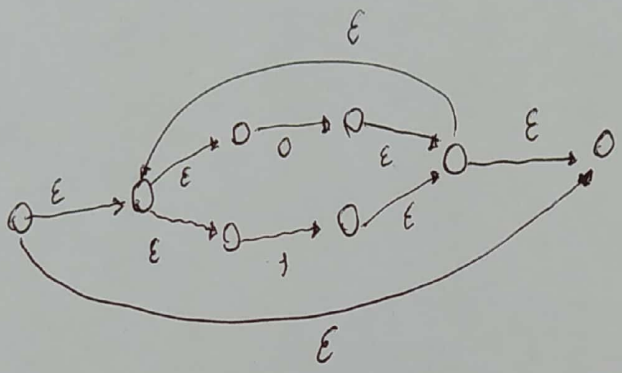
Questão 5) Converter a expressão regular $(0+1)^*1(0+1)$ em um autômato ε-NFA equivalente.

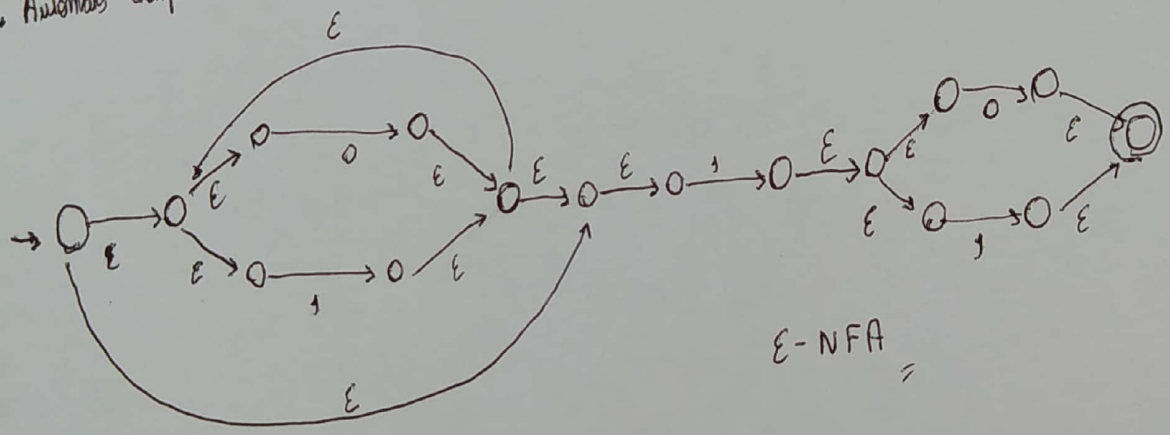
. Para $0+1$:



. Para $(0+1)^*$:



. Autômato Completo



ε-NFA =