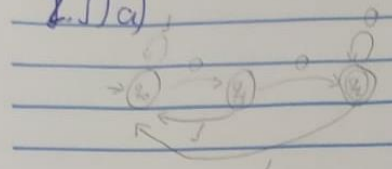
Lista de Exercícios 2

2.1) a)



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

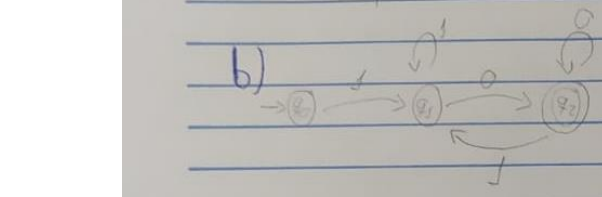
$Q = \{q_0, q_1, q_2\}$

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

$F = \{q_2\}$

$\delta =$	0	1
$\rightarrow q_0$	q_1	q_0
q_1	q_2	q_0
$*q_2$	q_2	q_0

b)



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

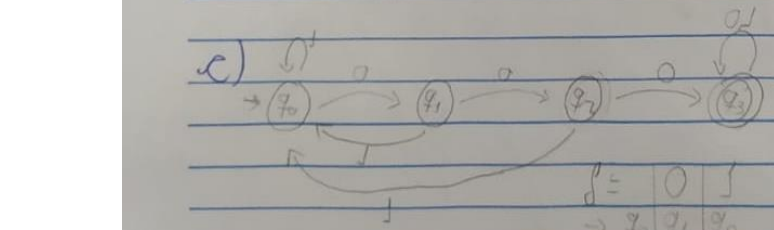
$Q = \{q_0, q_1, q_2\}$

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

$F = \{q_2\}$

$\delta =$	0	1
$\rightarrow q_0$	$\emptyset$	q_1
q_1	q_2	q_1
$*q_2$	q_2	q_1

c)



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

$Q = \{q_0, q_1, q_2, q_3\}$

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

$F = \{q_3\}$

$\delta =$	0	1
$\rightarrow q_0$	q_1	q_0
q_1	q_2	q_0
q_2	q_3	q_0
$*q_3$	q_3	q_3

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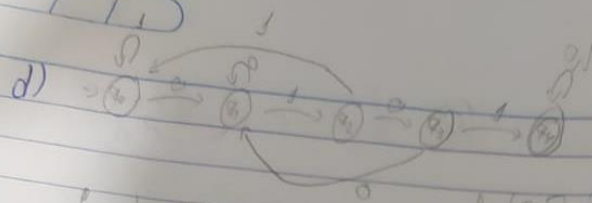
d)

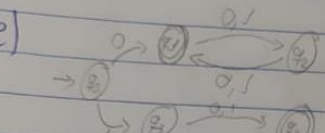


$\delta =$	0	1
$\to q_0$	q_3	q_0
q_1	q_3	q_2
q_2	q_3	q_0
q_3	q_3	q_4
$*\, q_4$	q_4	q_4

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

$Q = \{q_0, q_1, q_2, q_3, q_4\}$
$\Sigma = \{0, 1\}$
$F = \{q_4\}$

e)

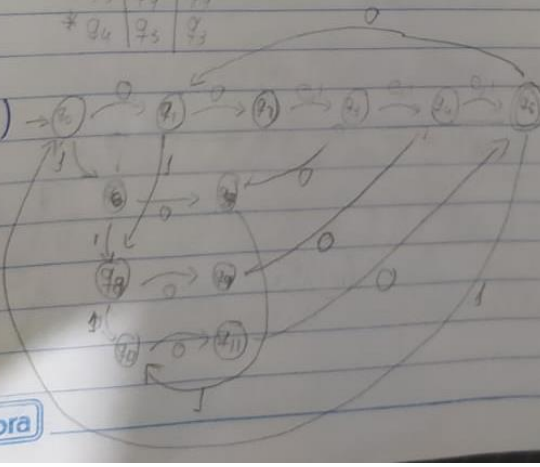


$A = (Q, \Sigma, \delta, q_0, F)$

$Q = \{q_0, q_1, q_2, q_3, q_4\}$
$\Sigma = \{0, 1\}$
$F = \{q_1, q_4\}$

$\delta =$	0	1
$\to q_0$	q_1	q_3
$*\, q_1$	q_2	q_2
q_2	q_1	q_1
q_3	q_4	q_4
$*\, q_4$	q_3	q_3

f)

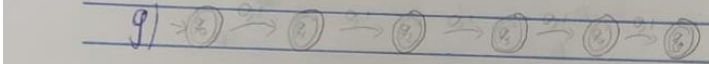


$A = (Q, \Sigma, \delta, q_0, F)$

$Q = \{q_0, q_1, q_2, q_3, q_4, q_5, q_6, q_7, q_8, q_9, q_{10}, q_{11}\}$
$\Sigma = \{0, 1\}$
$F = \{q_5\}$

δ =	0	1
→ q_0	q_1	q_6
	q_2	q_5
	q_3	q_3
	q_4	q_4
	q_5	q_5
* q_6	q_1	q_0
	q_7	q_8
	q_9	q_{10}
	q_{10}	q_{10}
	q_4	∅
	q_{11}	∅
	q_5	∅

g)



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

$Q = \{q_0, q_1, q_2, q_3, q_4, q_5\}$

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

$F = \{q_2, q_3, q_4, q_5\}$

δ =	0	1
q_0	q_1	q_1
q_1	q_2	q_2
q_2	q_3	q_3
q_3	q_4	q_4
q_4	q_5	q_5
q_5	∅	∅

h)

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

$Q = \{q_0\}$

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

$F = \{q_0\}$

δ =	0	1
→ * q_0	q_0	q_0

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2.2] a) $\hat{\delta}(q_0,1) = q_0 \Rightarrow \hat{\delta}(q_0,11) = \hat{\delta}(q_0,1) = q_0 \Rightarrow$
$\Rightarrow \hat{\delta}(q_0,110) = \hat{\delta}(q_0,0) = q_1 \Rightarrow \hat{\delta}(q_0,1100) = \hat{\delta}(q_1,0) = q_2$

b) $\hat{\delta}(q_0,1) = q_1 \Rightarrow \hat{\delta}(q_0,11) = \hat{\delta}(q_1,1) = q_1 \Rightarrow \hat{\delta}(q_0,110) = \hat{\delta}(q_1,0) = q_2 \Rightarrow$
$\Rightarrow \hat{\delta}(q_0,1100) = \hat{\delta}(q_2,0) = q_2$

c) $\hat{\delta}(q_0,1) = q_0 \Rightarrow \hat{\delta}(q_0,10) = \hat{\delta}(q_0,0) = q_1 \Rightarrow \hat{\delta}(q_0,100) = \hat{\delta}(q_1,0) = q_2 \Rightarrow$
$\hat{\delta}(q_0,1000) = \hat{\delta}(q_2,0) = q_3 \Rightarrow \hat{\delta}(q_0,10001) = \hat{\delta}(q_3,1) = q_3$

d) $\hat{\delta}(q_0,1) = q_0 \Rightarrow \hat{\delta}(q_0,11) = \hat{\delta}(q_0,1) = q_0 \Rightarrow \hat{\delta}(q_0,110) = \hat{\delta}(q_0,0) = q_1 \Rightarrow$
$\Rightarrow \hat{\delta}(q_0,1101) = \hat{\delta}(q_1,1) = q_2 \Rightarrow \hat{\delta}(q_0,11010) = \hat{\delta}(q_2,0) = q_3 \Rightarrow$
$\Rightarrow \hat{\delta}(q_0,110101) = \hat{\delta}(q_3,1) = q_4 \Rightarrow \hat{\delta}(q_0,1101010) = \hat{\delta}(q_4,0) = q_4 \Rightarrow$
$\Rightarrow \hat{\delta}(q_0,11010100) = \hat{\delta}(q_4,0) = q_4$

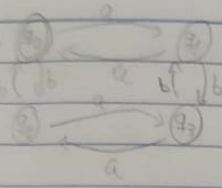
e) $\hat{\delta}(q_0,0) = q_1 \Rightarrow \hat{\delta}(q_0,01) = \hat{\delta}(q_1,1) = q_2 \Rightarrow \hat{\delta}(q_0,010) = \hat{\delta}(q_2,0) = q_1 \Rightarrow$
$\Rightarrow \hat{\delta}(q_0,0101) = \hat{\delta}(q_1,1) = q_2 \Rightarrow \hat{\delta}(q_0,01010) = \hat{\delta}(q_2,0) = q_1$

f) $\hat{\delta}(q_0,1) = q_0 \Rightarrow \hat{\delta}(q_0,11) = \hat{\delta}(q_0,1) = q_0 \Rightarrow \hat{\delta}(q_0,110) = \hat{\delta}(q_0,0) = q_1 \Rightarrow$
$\Rightarrow \hat{\delta}(q_0,1100) = \hat{\delta}(q_0,0) = q_1 \Rightarrow \hat{\delta}(q_0,11001) = \hat{\delta}(q_1,1) = q_5$

g) $\hat{\delta}(q_0,0) = q_1 \Rightarrow \hat{\delta}(q_0,00) = \hat{\delta}(q_1,0) = q_2 \Rightarrow \hat{\delta}(q_0,001) = \hat{\delta}(q_2,1) = q_3$

h) $\hat{\delta}(q_0,1) = q_0 \Rightarrow \hat{\delta}(q_0,10) = \hat{\delta}(q_0,0) = q_0 \Rightarrow \hat{\delta}(q_0,101) = \hat{\delta}(q_0,1) = q_0 \Rightarrow$
$\Rightarrow \hat{\delta}(q_0,1010) = \hat{\delta}(q_0,0) = q_0 \Rightarrow \hat{\delta}(q_0,10101) = \hat{\delta}(q_0,1) = q_0$

2.3) a)



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

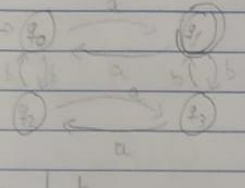
$Q = \{q_0, q_1, q_2, q_3\}$

$\Sigma = \{a, b\}$

$F = \{q_0\}$

δ	a	b
→ q_0	q_1	q_2
* q_1	q_0	q_3
q_2	q_3	q_0
q_3	q_2	q_1

b)



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

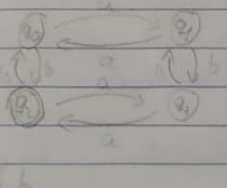
$Q = \{q_0, q_1, q_2, q_3\}$

$\Sigma = \{a, b\}$

$F = \{q_1\}$

δ	a	b
→ q_0	q_1	q_2
* q_1	q_0	q_3
q_2	q_3	q_0
q_3	q_2	q_1

c)



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

$Q = \{q_0, q_1, q_2, q_3\}$

$\Sigma = \{a, b\}$

$F = \{q_2\}$

δ	a	b
→ q_0	q_1	q_2
q_1	q_3	q_3
* q_2	q_2	q_0
q_3	q_2	q_1

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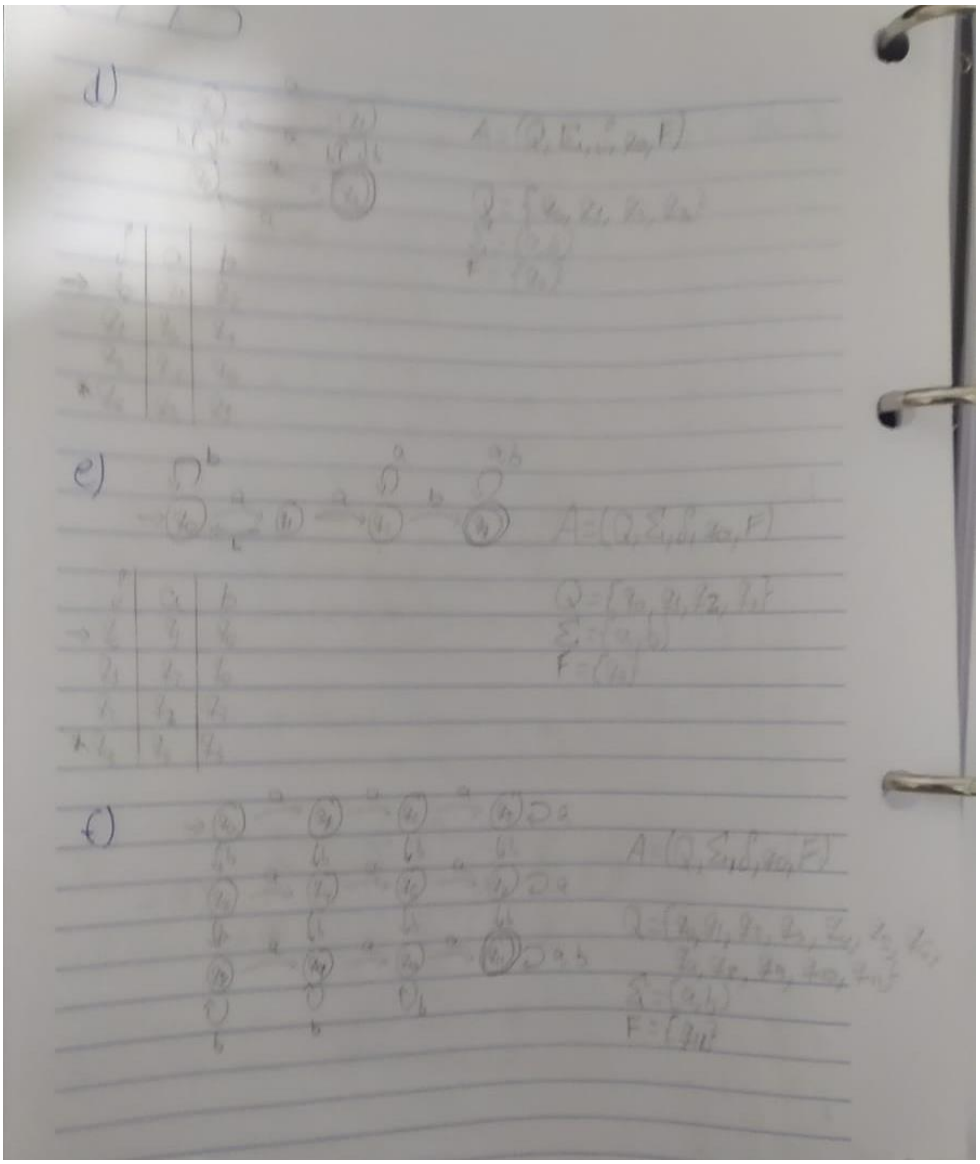
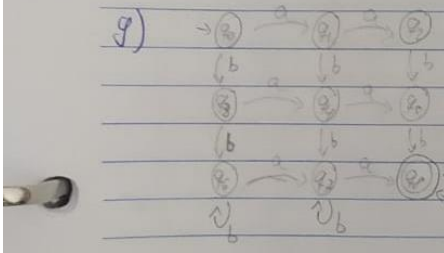


δ	a	b
→ q_0	q_1	q_2
q_1	q_3	q_4
q_2	q_4	q_8
q_3	q_5	q_6
q_4	q_6	q_9
q_5	q_5	q_2
q_6	q_2	q_{10}
q_7	q_7	q_{11}
q_8	q_9	q_8
q_9	q_{10}	q_9
q_{10}	q_{11}	q_{10}
* q_{11}	q_{11}	q_{11}

g)



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

$Q = \{q_0, q_1, q_2, q_3, q_4, q_5, q_6, q_7, q_8\}$

$\Sigma = \{a, b\}$

$F = \{q_0\}$

δ	a	b
→ q_0	q_1	q_3
q_1	q_2	q_4
q_2	$\emptyset$	q_5
q_3	q_4	q_6
q_4	q_2	q_7
q_5	$\emptyset$	q_8
q_6	q_2	q_6
q_7	q_8	q_4
* q_8	$\emptyset$	q_8

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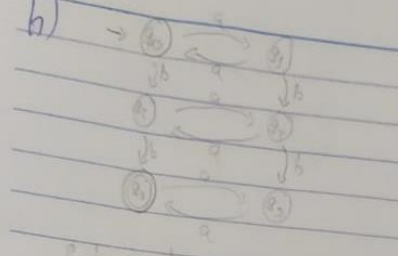
b)



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

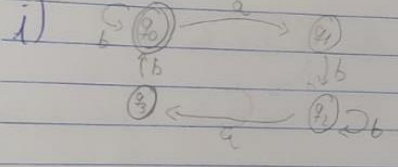
$Q = \{q_0, q_1, q_2, q_3, q_4, q_5\}$

$\Sigma = \{a, b\}$

$F = \{q_3\}$

δ	a	b
$\rightarrow q_0$	q_1	q_2
q_1	q_0	q_4
q_2	q_4	q_3
$*q_3$	q_5	$\emptyset$
q_4	q_2	q_5
q_5	q_3	$\emptyset$

i)



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

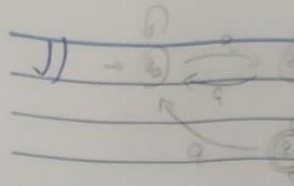
$Q = \{q_0, q_1, q_2, q_3\}$

$\Sigma = \{a, b\}$

$F = \{q_2\}$

δ	a	b
$\rightarrow *q_0$	q_1	q_0
q_1	$\emptyset$	q_2
q_2	q_3	q_2
q_3	$\emptyset$	q_0

J)



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

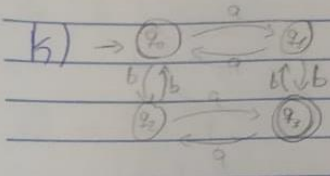
$Q = \{q_0, q_1, q_2\}$

$\Sigma = \{a, b\}$

$F = \{q_2\}$

δ	a	b
$\rightarrow q_0$	q_1	q_0
q_1	q_0	q_2
$*q_2$	q_0	q_2

k)



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

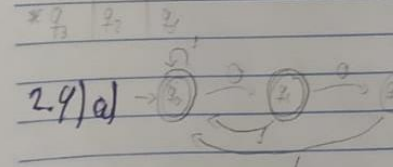
$Q = \{q_0, q_1, q_2, q_3\}$

$\Sigma = \{a, b\}$

$F = \{q_3\}$

δ	a	b
$\rightarrow q_0$	q_1	q_2
q_1	q_0	q_3
q_2	q_3	q_0
$*q_3$	q_2	q_1

2.9) a)



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

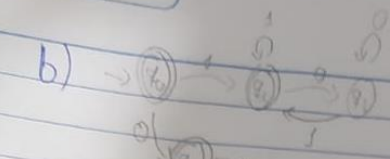
$Q = \{q_0, q_1, q_2\}$

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

$F = \{q_0, q_1\}$

δ	0	1
$\rightarrow *q_0$	q_1	q_0
$*q_1$	q_1	q_0
q_2	q_2	q_0

b)



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

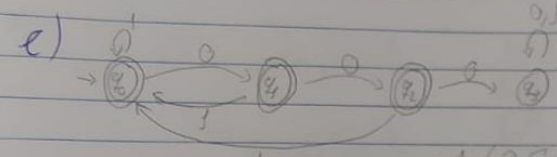
$Q = \{q_0, q_1, q_2, q_3\}$

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

$F = \{q_0, q_1, q_3\}$

δ	0	1
$\rightarrow *q_0$	q_2	q_1
$*q_1$	q_2	q_1
q_2	q_2	q_1
$*q_3$	q_3	q_3

c)



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

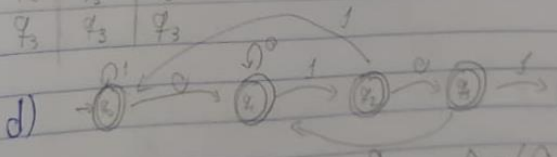
$Q = \{q_0, q_1, q_2, q_3\}$

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

$F = \{q_0, q_1, q_2\}$

δ	0	1
$\rightarrow *q_0$	q_1	q_0
$*q_1$	q_2	q_0
$*q_2$	q_3	q_0
q_3	q_3	q_3

d)



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

$Q = \{q_0, q_1, q_2, q_3, q_4\}$

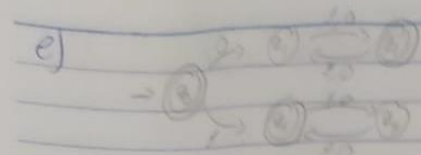
$\Sigma = \{0, 1\}$

$F = \{q_0, q_1, q_2, q_3\}$

δ	0	1
$\rightarrow *q_0$	q_1	q_0
$*q_1$	q_1	q_2
$*q_2$	q_3	q_0
$*q_3$	q_1	q_4
q_4	q_4	q_4

tilibra

e)



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

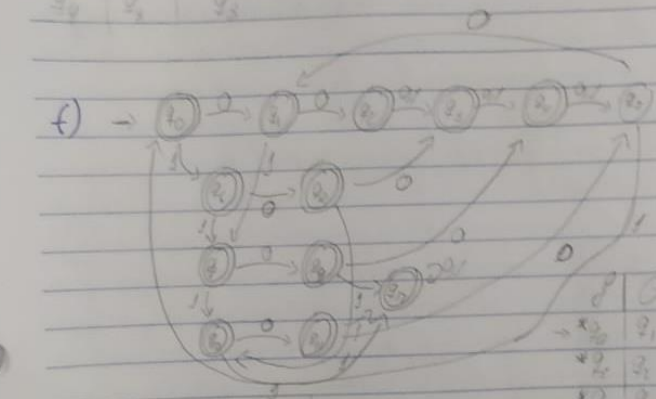
$Q = \{q_0, q_1, q_2, q_3, q_4\}$

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

$F = \{q_0, q_3, q_4\}$

δ	0	1
$\rightarrow *q_0$	q_1	q_3
q_1	q_2	q_3
$*q_2$	q_1	q_4
$*q_3$	q_0	q_3
q_4	q_3	q_3

f) →



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

$Q = \{q_0, q_1, q_2, q_3, q_4, q_5, q_6, q_7, q_8, q_9, q_{10}, q_{11}, q_{12}\}$

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

$F = \{q_0, q_1, q_2, q_3, q_4, q_5, q_6, q_7, q_8, q_9, q_{10}, q_{11}, q_{12}\}$

δ	0	1
$\rightarrow *q_0$	q_1	q_6
$*q_1$	q_1	q_7
$*q_2$	q_2	q_8
$*q_3$	q_3	q_9
$*q_4$	q_5	q_1
q_5	q_1	q_{10}
$*q_6$	q_2	q_{11}
$*q_7$	q_3	q_{12}
$*q_8$	q_4	q_{12}
$*q_9$	q_5	q_{12}
$*q_{10}$	q_{11}	q_{12}
$*q_{11}$	q_5	q_{12}
$*q_{12}$	q_{12}	q_{12}

tilibra

g)

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

$Q = \{q_0, q_1, q_2, q_3, q_4, q_5, q_6\}$

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

$F = \{q_6\}$

δ	0	1
$\to q_0$	q_1	q_1
q_1	q_2	q_2
q_2	q_3	q_3
q_3	q_4	q_4
q_4	q_5	q_5
q_5	q_6	q_6
$*q_6$	q_6	q_6

h)

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

$Q = \{q_0\}$; $\Sigma = \{0, 1\}$; $F = \{\}$

δ	0	1
$\to q_0$	q_0	q_0

i)

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

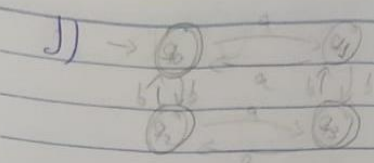
$Q = \{q_0, q_1, q_2, q_3\}$

$\Sigma = \{a, b\}$

$F = \{q_1, q_2, q_3\}$

δ	a	b
$\to q_0$	q_1	q_2
$*q_1$	q_0	q_3
$*q_2$	q_3	q_0
$*q_3$	q_2	q_1

J)



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

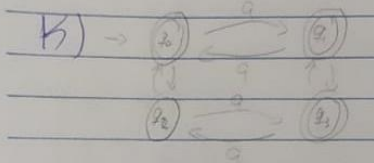
$Q = \{q_0, q_1, q_2, q_3\}$

$\Sigma = \{a, b\}$

$F = \{q_0, q_2, q_3\}$

δ	a	b
$\rightarrow *q_0$	q_1	q_2
q_1	q_0	q_3
$*q_2$	q_3	q_0
$*q_3$	q_2	q_1

K)



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

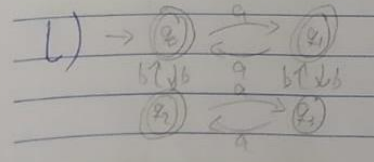
$Q = \{q_0, q_1, q_2, q_3\}$

$\Sigma = \{a, b\}$

$F = \{q_0, q_1, q_3\}$

δ	a	b
$\rightarrow *q_0$	q_1	q_2
$*q_1$	q_0	q_3
q_2	q_3	q_0
$*q_3$	q_2	q_1

L)



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

$Q = \{q_0, q_1, q_2, q_3\}$

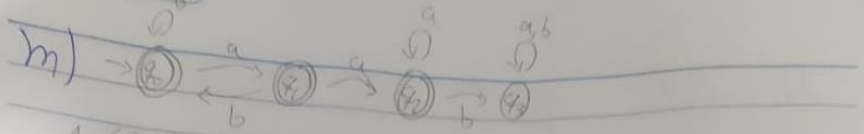
$\Sigma = \{a, b\}$

$F = \{q_0, q_1, q_2\}$

δ	a	b
$\rightarrow *q_0$	q_1	q_2
$*q_1$	q_2	q_3
$*q_2$	q_3	q_0
q_3	q_2	q_1

tilibra

m)



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

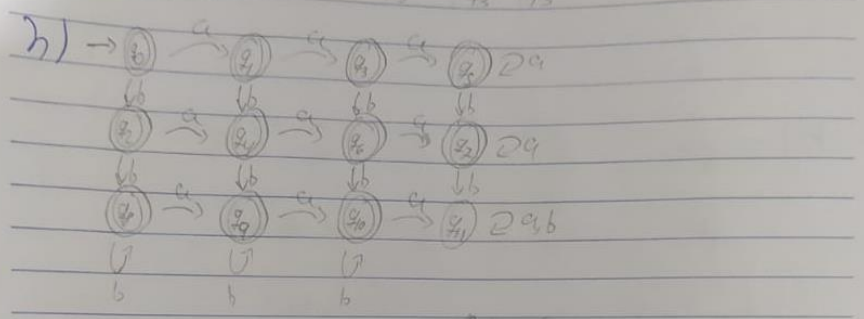
$Q=\{q_0, q_1, q_2, q_3\}$

$\Sigma=\{a, b\}$

$F=\{q_0, q_1, q_2\}$

δ	a	b
$\rightarrow *q_0$	q_1	q_0
$*q_1$	q_2	q_0
$*q_2$	q_3	q_3
q_3	q_3	q_3

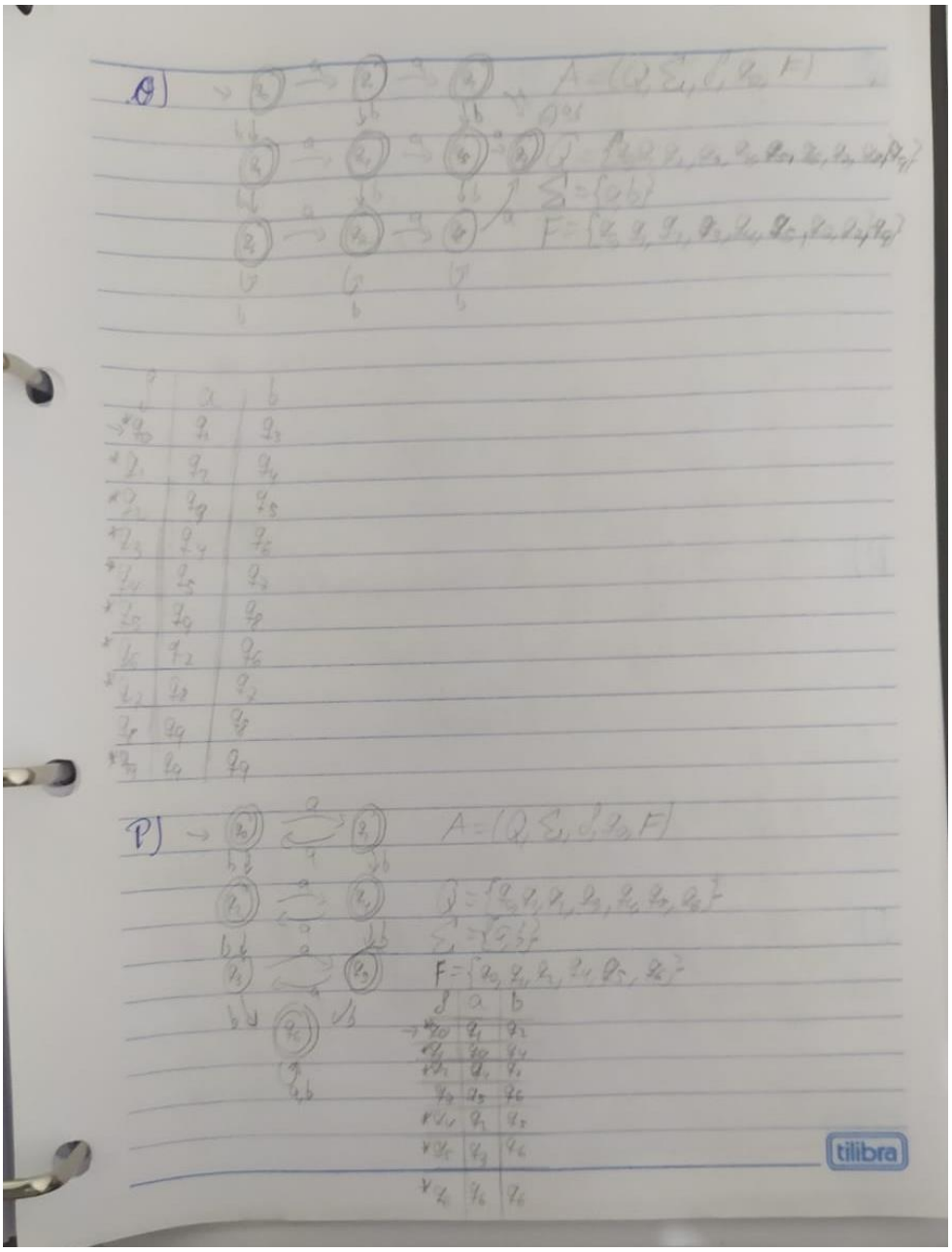
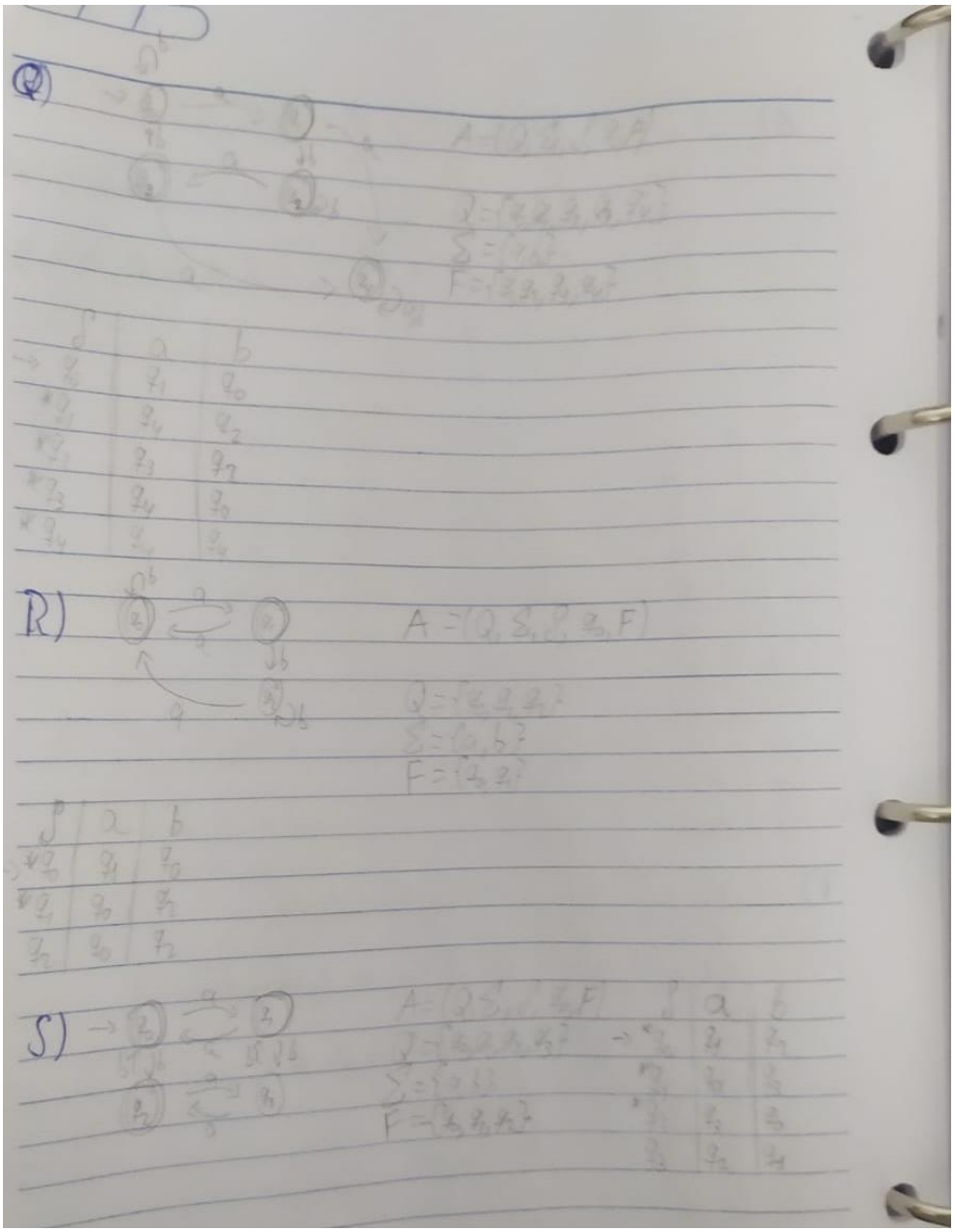
n)



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

$Q=\{q_0, q_1, q_2, q_3, q_4, q_5, q_6, q_7, q_8, q_9, q_{10}, q_{11}\}$

$\Sigma=\{a, b\}$

$F=\{q_0, q_1, q_3, q_4, q_5, q_6, q_7, q_8, q_9, q_{10}\}$

δ	a	b
$\rightarrow *q_0$	q_1	q_2
$*q_1$	q_3	q_4
$*q_2$	q_4	q_8
$*q_3$	q_5	q_6
$*q_4$	q_6	q_9
$*q_5$	q_5	q_2
$*q_6$	q_2	q_{10}
$*q_7$	q_2	q_{11}
$*q_8$	q_9	q_8
$*q_9$	q_{10}	q_9
$*q_{10}$	q_{11}	q_{10}
q_{11}	q_{11}	q_{11}