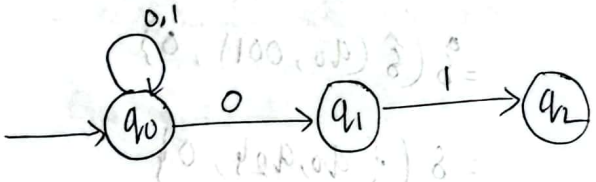
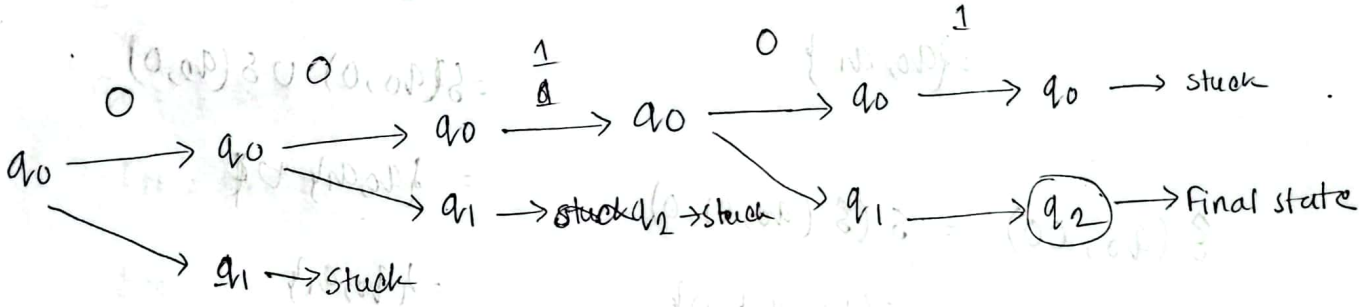
NFA

- Multiple output possible

$(0,1)^*01$ show the states NFA for the input 00101





- Transitio table of that NFA

	0	1
→ q_0	$\{q_0, q_1\}$	$\{q_0\}$
q_1	ϕ	$\{q_2\}$
*q_2	ϕ	ϕ

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

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

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

$q_0 = \{0,1\}$

$F = \{q_2\}$

$\delta = \{((q_0,0), q_0), ((q_0,0), q_1),$

$((q_0,1), q_0), (q_1,1), q_2))$

Extended transition function of NFA

00101

$\hat{\delta}(q_0, \epsilon) = q_0$

$\hat{\delta}(q_0, 0) = \delta(\hat{\delta}(q_0, \epsilon), 0)$

$= \delta(\{q_0\}, 0)$

$= \delta(q_0, 0)$

$= \{q_0, q_1\}$

$\hat{\delta}(q_0, 00) = \delta(\hat{\delta}(q_0, 0), 0)$

$= \delta(\{q_0, q_1\}, 0)$

$= \delta(q_0, 0) \cup \delta(q_1, 0)$

$= \{q_0, q_1\} \cup \phi$

$= \{q_0, q_1\}$

$\hat{\delta}(q_0, 001) = \delta(\hat{\delta}(q_0, 00), 1)$

$= \delta(\{q_0, q_1\}, 1)$

$= \delta(q_0, 1) \cup \delta(q_1, 1)$

$= \{q_0\} \cup \{q_2\}$

$= \{q_0, q_2\}$

$\hat{\delta}(q_0, 0010)$

$= \delta(\hat{\delta}(q_0, 001), 0)$

$= \delta(\{q_0, q_2\}, 0)$

$= \delta(q_0, 0) \cup \delta(q_2, 0)$

$= \{q_0, q_1\} \cup \phi$

$= \{q_0, q_1\}$

$\hat{\delta}(q_0, 00101)$

$= \delta(\hat{\delta}(q_0, 0010), 1)$

$= \delta(\{q_0, q_1\}, 1)$

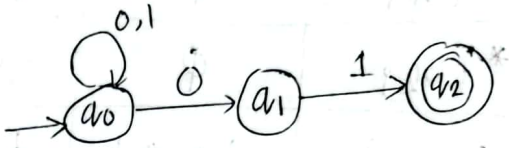
$= \delta(q_0, 1) \cup \delta(q_1, 1)$

$= \{q_0\} \cup \{q_2\}$

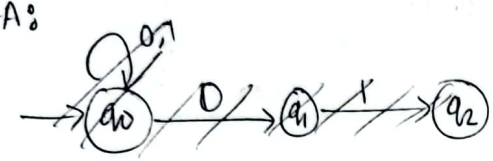
$= \{q_0, q_2\}$ Final state Accepted

NFA → DFA

- $(0|1)^*01$



NFA:



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

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

$q_0 = \{q_0\}$

$F_N = \{q_2\}$

δ_N

DFA:

~~$Q_D = \{q_0, q_1, q_2\}$~~

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

$q_0 = q_0$

$2^{\wedge} = 2^3 = Q_D = \{\{\Phi\}, \{q_0\}, \{q_1\}, \{q_2\}, \{q_0 q_1\}, \{q_0, q_2\}, \{q_1, q_2\}, \{q_0, q_1, q_2\}\}$

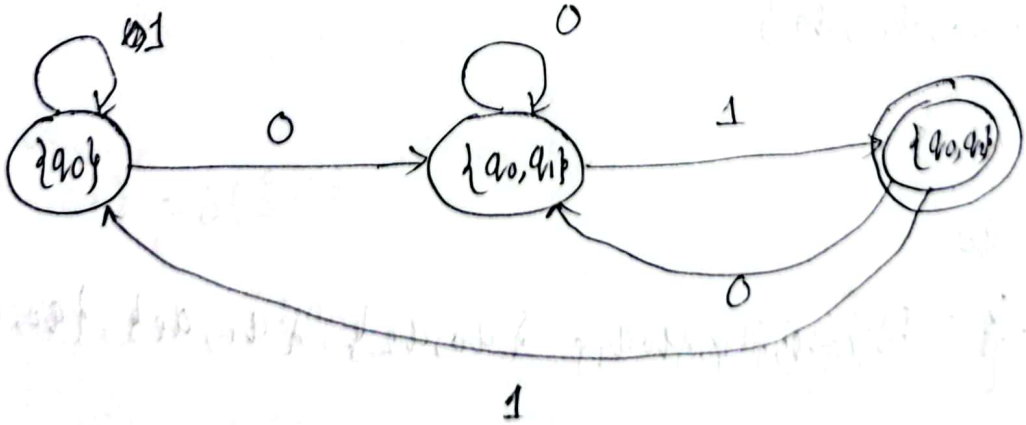
$F_N = \{\{q_2\}, \{q_0, q_2\}, \{q_1, q_2\}, \{q_0, q_1, q_2\}\}$

	0	1
ϕ	ϕ	ϕ
$\{q_0\}$	$\{q_0\}, q_1\}$	$\phi\{q_0\}$
$\{q_1\}$	ϕ	$\{q_2\}$
$*\{q_2\}$	ϕ	ϕ
$\{q_0, q_1\}$	$\{q_0, q_1\}$	$\{q_0, q_2\}$
$*\{q_0, q_2\}$	$\{q_0\}, q_1\}$	$\{q_0\}$
$*\{q_1, q_2\}$	ϕ	$\{q_2\}$
$*\{q_0, q_1, q_2\}$	$\{q_0, q_1\}$	$\{q_0, q_2\}$

q_0 q_1

q_0 q_2

DFA



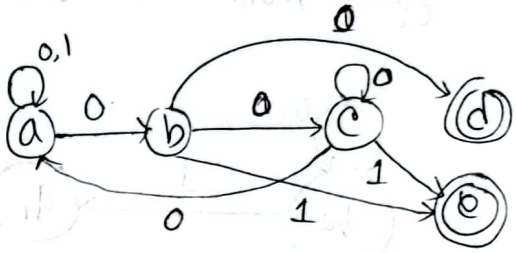
~~Decipher~~

Fall - 2021

2.a)

	0	1
→ a	{a,b}	{a}
b	{c,d}	{e}
c	{a,c}	{e}
*d	ϕ	ϕ
*e	ϕ	ϕ

NFA



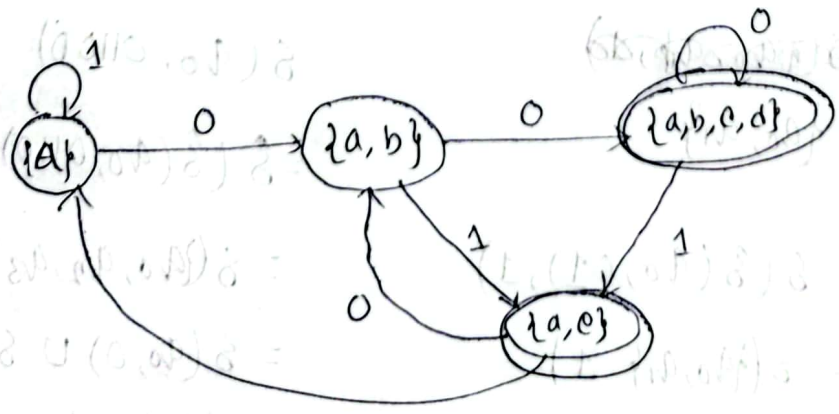
DFA

a	0	1
→ a	{a,b}	{a}
{a,b}	{a,b,c,d}	{a,e}
*{a,b,c,d}	{a,b,c,d}	{a,e}
*{a,e}	{a,b}	{a}

(a,b) ∪ (c,d)

(a) e

(a,b) ∪ (a, e

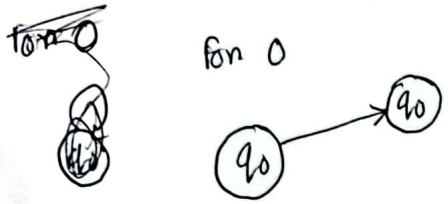


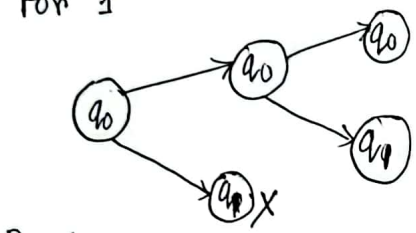
6.a)

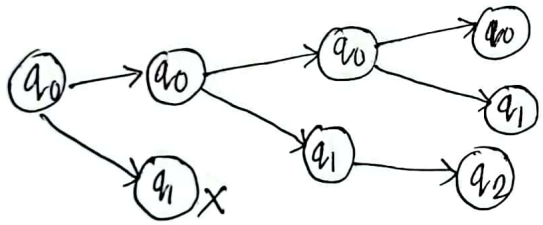
Construct NFA that accept all string over {0,1} where the 3rd symbol from the end is 1

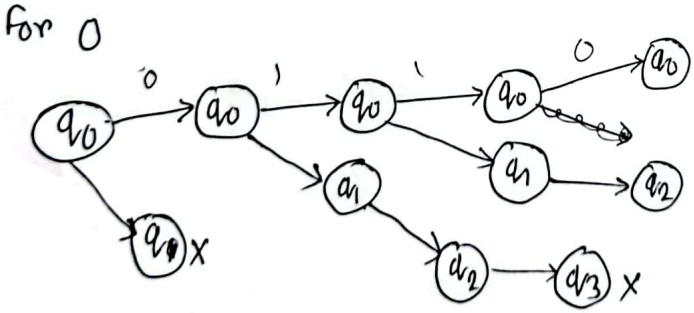
01100

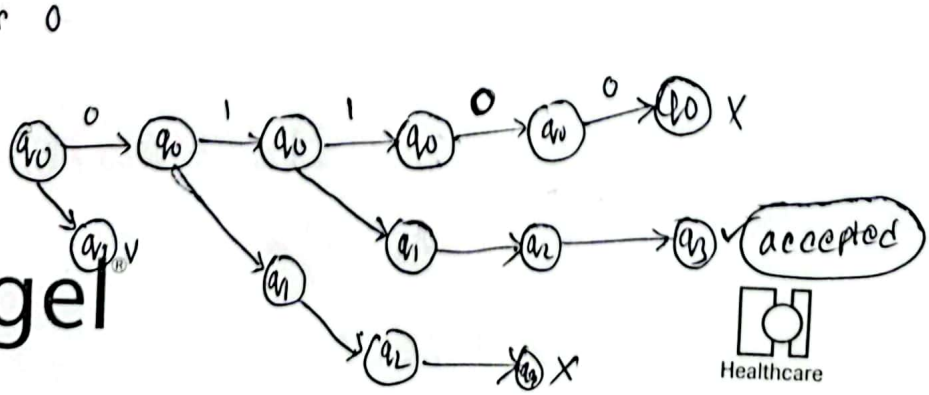
show the states











Sergel
Esomeprazole USP
Healthcare

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

sure

)

0)

1,0) ∪ δ(q2,0)

) {q3}

)

10), 0)

q3}, 0}

) δ(q2,0) ∪ δ(q3,0)

q3} ∪ φ

!

-> final state

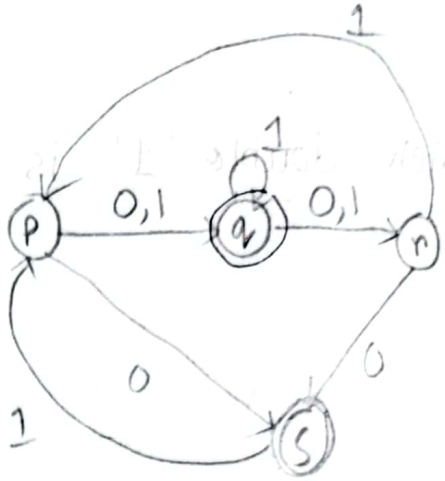
Accepted]

Spring 2020

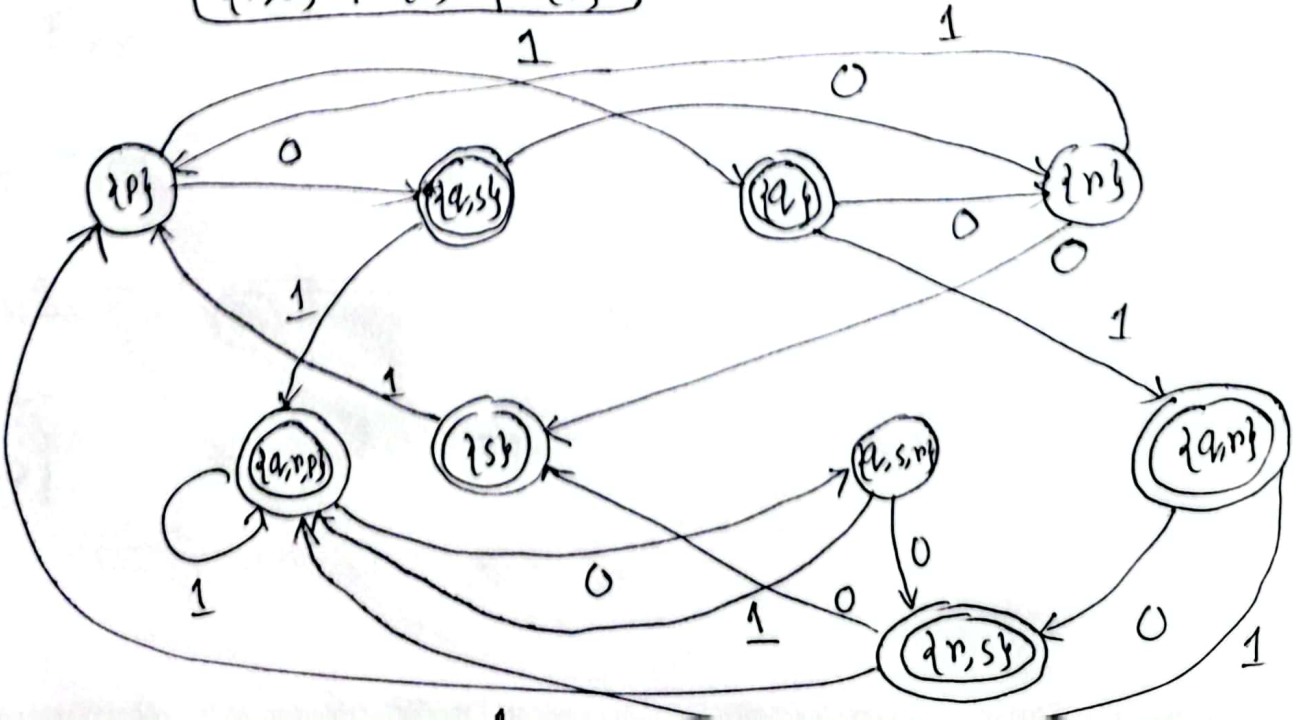
3. a) which double '1' is followed by 0 at the end

3.b

	0	1
→p	{q,s}	{q}
*q	{r}	{q,r}
r	{s}	{p}
*s	φ	{p}

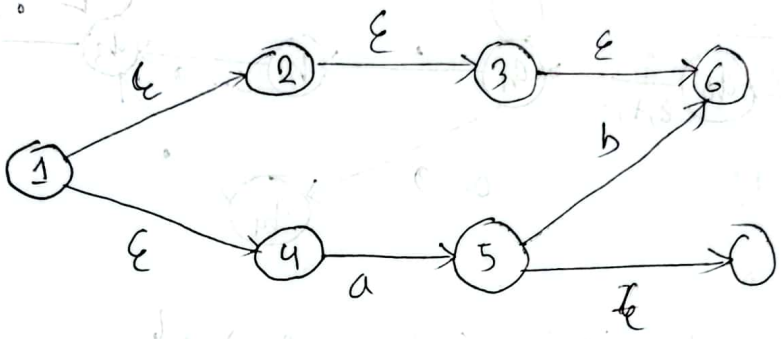


	0	1
→p	{q,s}	{q}
*{q,s}	{r}	{q,r,p}
*{q}	{r}	{q,r}
{r}	{s}	{p}
*{q,r,p}	{q,s,r}	{q,r,p}
*{s}	φ	{p}
*{q,s,r}	{r,s}	{p,q,r}
*{q,r}	{r,s}	{p,q,r}
*{r,s}	{s}	{p}



Epsilon NFA

- Epsilon closure:

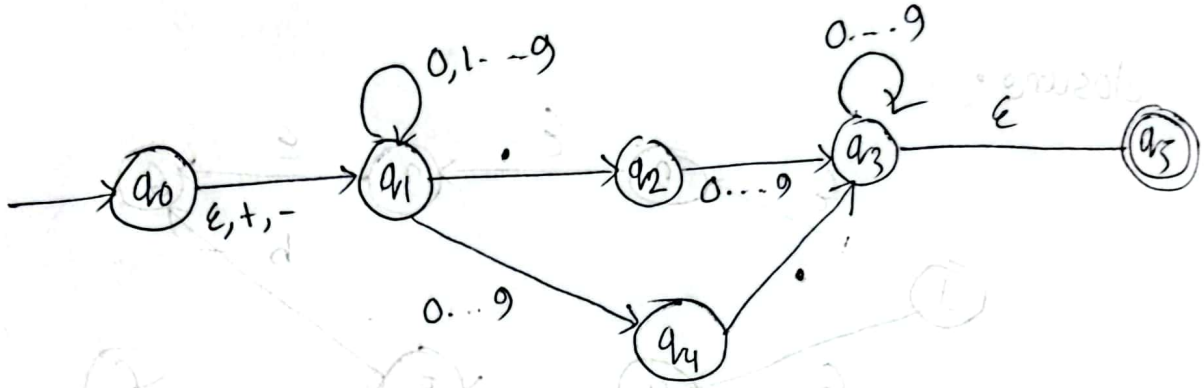


ECLOSE 3 = {3, 6}

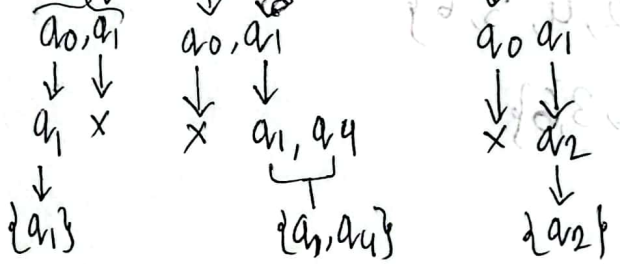
ECLOSE 1 = {1, 2, 4, 3, 6}

ECLOSE 2 = {2, 3, 6}

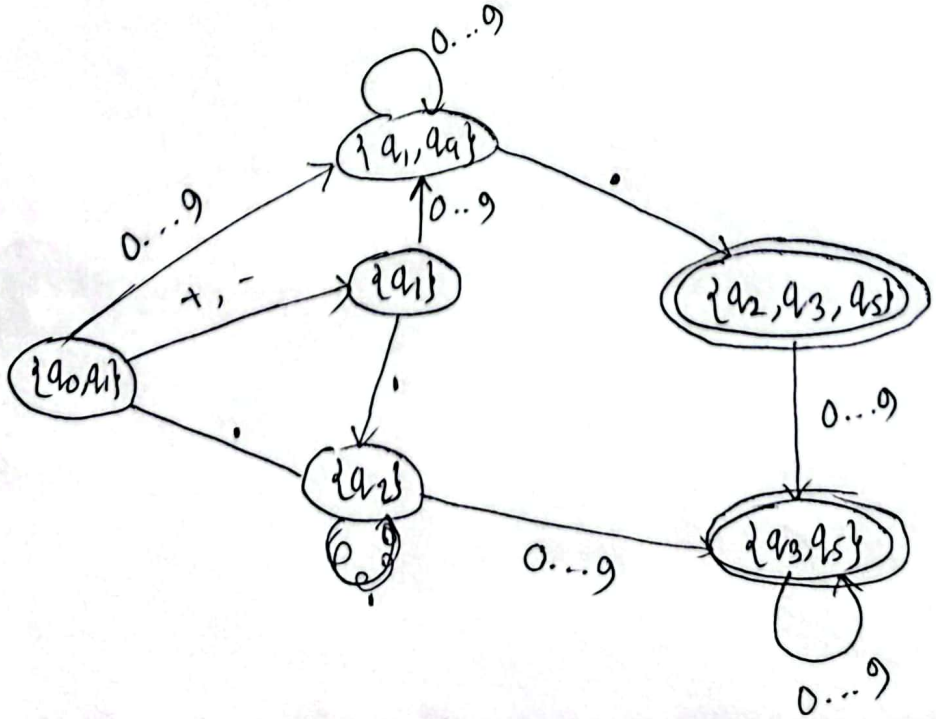
ε NFA to DFA



ECLOSE(q_0) = $\{q_0, q_1\}$ → ε = {+, -, 0...9, .}



~~ECLOSE(q0)~~ .



$\{q_1\} \longrightarrow \varepsilon = \{0 \ldots 9, \cdot\}$

$= q_1 \quad q_2$

$\{q_1, q_4\} \quad \{q_2\}$

$q_1 \; q_4 \quad q_2$

$\{q_1, q_4\} \longrightarrow \varepsilon = \{0 \ldots 9, \cdot\}$

$= q_1, q_4 \quad q_1 q_4$

$q_1, q_4 \quad \times \quad q_2, q_3$

$\{q_1 \; q_4\} \quad \{q_2, q_3, q_5\}$

$\{q_2, q_3, q_5\} \longrightarrow \varepsilon = \{0 \ldots 9\}$

$= q_2, q_3, q_5$

$q_3 \quad q_3 \quad \times$

$q_3, q_5 \quad q_3, q_5$

$\{q_2\} \longrightarrow \varepsilon = \{0 \ldots 9\}$

$= q_2$

q_3

q_3, q_5

$\{q_3, q_5\} \rightarrow \varepsilon = \{0 \ldots 9\}$

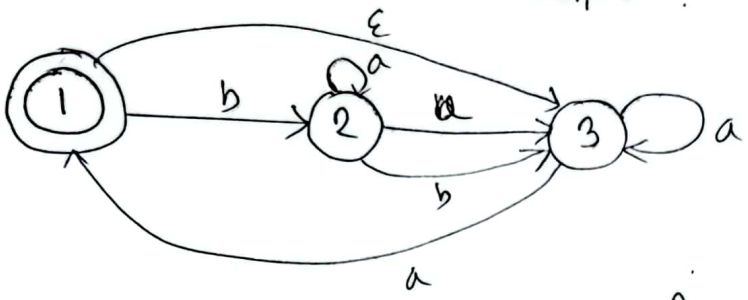
$= q_3, q_5$

$q_3 q_5 \quad \times$

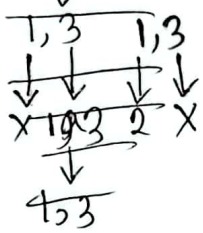
	+	-	0..9	.
$\rightarrow\{q_0, q_1\}$	$\{q_1\}$	$\{q_1\}$	$\{q_1, q_4\}$	$\{q_2\}$
$\{q_1\}$	ϕ	ϕ	$\{q_1, q_4\}$	$\{q_2\}$
$\{q_1, q_4\}$	ϕ	ϕ	$\{q_1, q_4\}$	$\{q_2, q_3, q_5\}$
$\{q_2\}$	ϕ	ϕ	q_3, q_5	ϕ
$\{q_3, q_5\}$	ϕ	ϕ	$\{q_3, q_5\}$	ϕ
$\{q_2, q_3, q_5\}$	ϕ	ϕ	$\{q_3, q_5\}$	ϕ

Decipher.

3.a)



~~E(1) = {1,3} → ε = {a, b}~~



~~{2,3} → ε = {a, b}~~

= 2,

	a	b
*→{1,3}	{1,3}	{2}
{2}	{2,3}	{3}
{2,3}	{1,2,3}	{3}
{1,2,3}	{1,2,3}	{2,3}
{3}	{1,3}	ϕ

EClose{1} = {1,3}

EClose{2} = {2}

EClose{3} = {3}