

Fall - 29

5. Design Regular Expression for the following languages :

1x3

- a) Three mobile phone operators are working in the country. Their **prefixes** are **011, 010, 001**. The phone numbers are **10 digits** in length, including the prefix. The rest of the digits in the numbers can be any of the digits from 0 to 9. Denote the alphabet set and design regular expressions that detect the language for this scenario.
- b) A person can get a traffic ticket or not one per day. Getting a traffic ticket is denoted by **T**, and not getting one is denoted by **N**. Each symbol, based on its position in a string, represents the ticket status on that particular day. For example, **TNT** denotes that the person received tickets on the first and the third day. Denote the alphabet and design regular expressions for the following scenarios.
- All strings where at least three tickets were received
 - All strings where less than three tickets were received

Soln:

~~sta~~ $(011 \cup 010 \cup 001)^*$

~~b1~~ ① $\Sigma^* T^* T^* T^* T^*$

② $N^* \cup N^* TN^* \cup N^* TN^* TN^*$

Ans

Summer - 24

5. Design Regular Expression for the following languages :

- $L = \{w \mid w \text{ does not contain } \text{xxx} \text{ over the alphabet } \{x, y\}\}$
- $L = \{w \mid w \text{ starts with } \underline{\mathbf{b}} \text{ and contains at most 3 a's over the alphabet } \{a, b, c\}\}$
- $L = \{w \mid w \text{ contains an even number of a's over the alphabet } \underline{\{a, b\}}\}$

Sol(n):

a) $y^* (e \cup ny^+ \cup nx^+)^* (n \cup nn \cup e)$

b) $b^+ \cup b^+ ab^* \cup b^+ ab^* ab^* \cup b^+ ab^* ab^* ab^* ab^*$

c) $(b^* a b^* a b^*)^*$

Acs

Spring - 29

5. Design Regular Expression for the following languages where $\Sigma = \{a, b\}$:

- a) $W \mid W \text{ contains not more than one occurrence of the substring 'aa'}$
- b) $W \mid W \text{ does not end with 'ab'}$
- c) $W \mid W \text{ starts with } b \text{ and ends with } b$

Soln:

a)

$$b^*(ab^+)^*(a \cup \epsilon) \cup b^*(ab^+)^*aa(b^+(ab^+)(a \cup \epsilon))^*\Sigma^*$$

b) a, b, aa, bb, ba

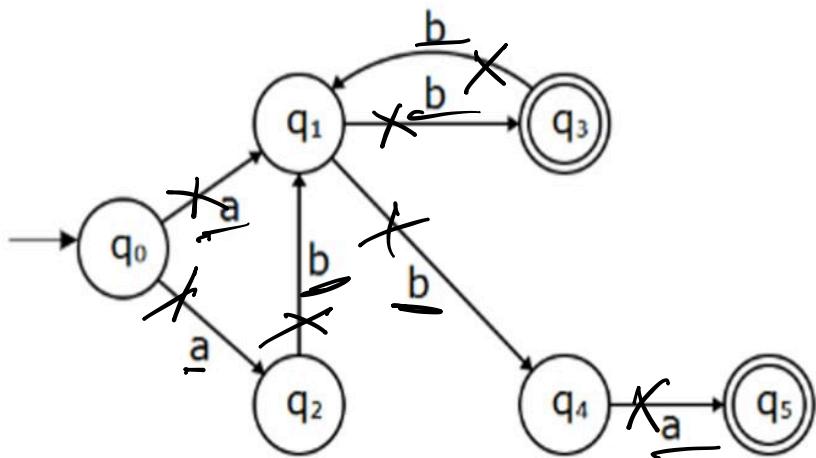
$$\Sigma^*a \cup \Sigma^*b \cup \Sigma^*aa \cup \Sigma^*bb \cup \Sigma^*ba$$

c) b Σ^* a

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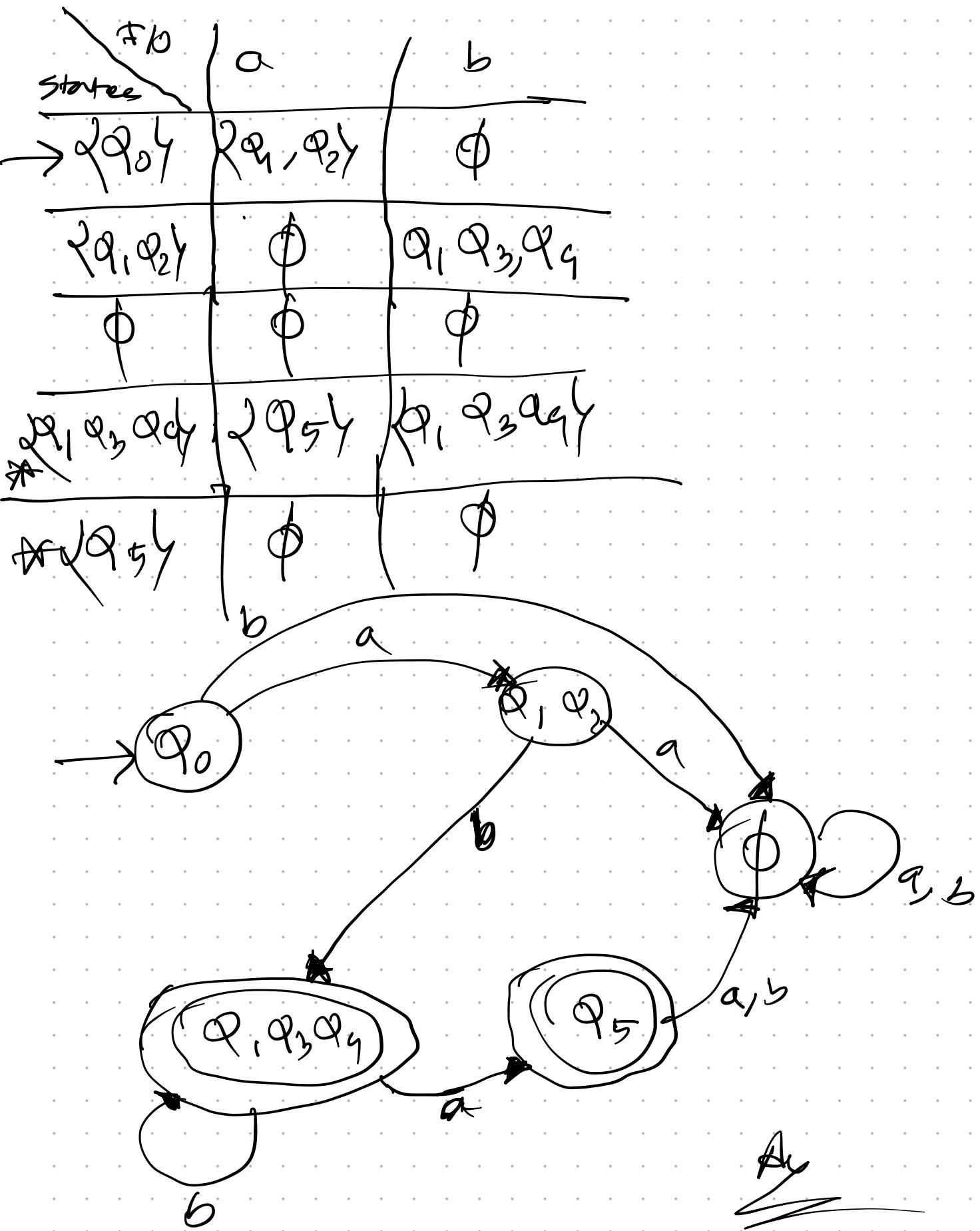
4.

Convert the following NFA over the alphabet $\Sigma = \{a, b\}$ to an equivalent DFA.



Ans:

①	DFA	
States	a	b
Q_0	Q_1, Q_2	\emptyset
Q_1	\emptyset	Q_3, Q_4
Q_2	\emptyset	Q_1
Q_3	\emptyset	Q_1
Q_4	Q_5	\emptyset
Q_5	\emptyset	\emptyset



5

b) Convert the following languages to their corresponding regular expression:

i) $L = \{\text{strings such that the } \underline{\text{4th symbol}} \text{ from the right is } b \text{ over the alphabet } \{a, b\}\}$

ii) $L = \{\text{strings such that they start and end with 'a' over the alphabet } \{a, b, c\}\}$

Ans:

b ___

① $\Sigma^* b \Sigma \Sigma \Sigma$

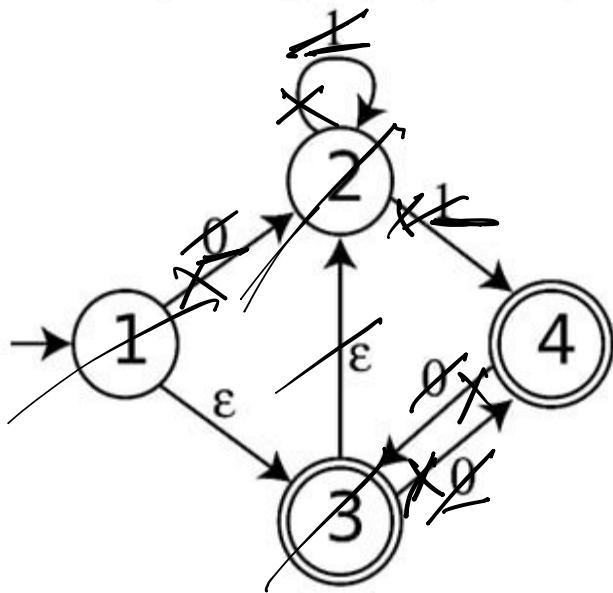
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② $a \Sigma^* a \cup a$

An

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5. Convert the following ϵ -NFA over alphabet $\Sigma = \{0,1\}$ to an equivalent DFA.



Ans:

NFA Table

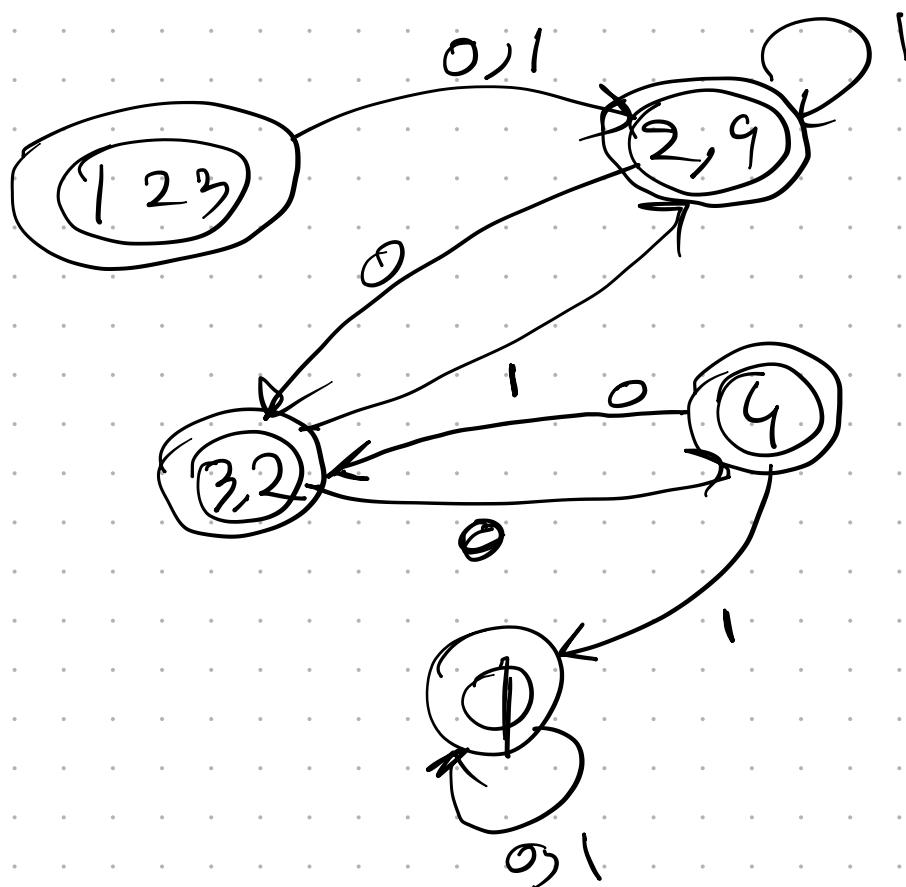
From	0	1
States		
$\rightarrow 1$	2	\emptyset
2	\emptyset	$\xrightarrow{0} 3$
$\ast 3$	\emptyset	\emptyset
$\ast 4$	3	\emptyset

E-close Tab

states	Eclose
$\rightarrow 1$	1, 3, 2
2	2
$\ast 3$	3, 2
$\ast 4$	3

DFA Table

States	0	1
* {2,1,2,3,4}	{2,4}	{3,9,4}
* {2,9,4}	{3,2,4}	{2,9,4}
* {2,3,2,4}	{9,4}	{2,9,4}
* {4,9,4}	{3,2,4}	\emptyset
\emptyset	\emptyset	\emptyset



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