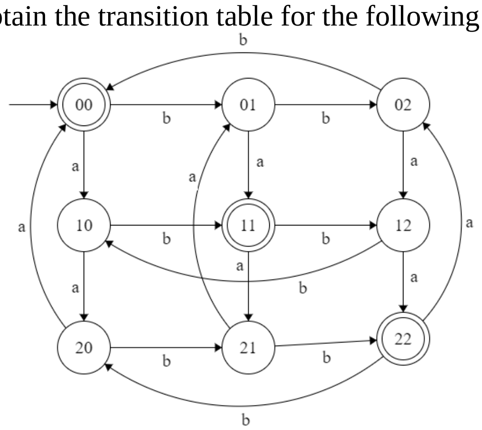
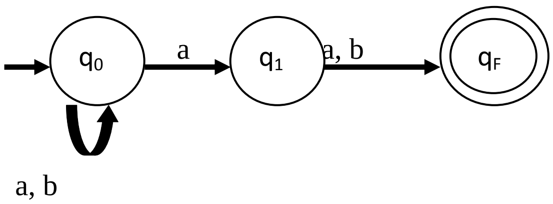
IAT 1 Question and Solutions

1 (a)	Explain with example: i) Power of an alphabet ii)String reversal iii) Substring iv) Language	[4]	CO 1	L1
(b)	If ‘w’ and ‘x’ are strings, Show that $(wx)^R = x^R w^R$ and give an example.	[6]	CO 1	L1
2 (a)	Write the formal definition of DFSM with a proper example.	[4]	CO 2	L3
(b)	Design DFSM to accept the following languages. i) L= {w∈ {a, b} *, ∀ x, y ∈ {a, b} *, (|w|%3=0)} ii) L= {w ∈ Σ* | w ≠ ε and e first and last character of w are the same}	[6]	CO 2	L3
3 (a)	Design a NDFSM with ∑ = {0, 1} that accepts all string in which the third symbol from the right end is always 0.	[4]	CO 2	L3
(b)	Let L1 and L2 be the two languages such that L = {001, 10, 111} and M = {ϵ, 001}, Find L∪M, L.M, L-M, M-L, L* when L = {0, 11}, L* when L = {0, 1}.	[6]	CO 3	L2
4 (a)	Write a note on applications of theory of computation and compiler design.	[4]	CO 1	L1
(b)	Obtain the transition table for the following DFSM:  	[6]	CO 2	L3
5 (a)	Describe NDFSM using formal notation. Convert the following NDFSM to its equivalent DFSM (using subset construction method).  	[10]	CO2	L3
6 (a)	Obtain a DFSM for the following language- L1= {starts with ‘a’ and ends with b} and L2= {starts with ‘b’ and ends with ‘a’}. Then L= L1 ∪L2.	[10]	CO2	L3

Solution:

(1a) Power of an alphabet :- denoted by Σ^n where for some integers 'n', the set of strings of length 'n' with symbols from 'Σ'.

$\Sigma^n = \{w \mid w \text{ is a string over and } |w| = n\}$

Σ^0 = strings of length 0 = $\{\lambda\}$.

$\Sigma^1 = \{a, b\}$.

$\Sigma^2 = \{a, b\}, \{a, b\} = \{ab, ba, aa, bb\}$

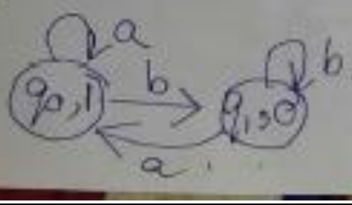
$\boxed{\text{Finite State M/c with output}}$.

Moore Machine :-

$M = (Q, \Sigma, \delta, q_0, \Delta, \lambda)$

- Q — finite set of states
- Σ — Input alphabet
- Δ — Output alphabet
- λ — Output function.

$\underset{1}{q_0} \xrightarrow{a} \underset{1}{q_0} \xrightarrow{b} \underset{0}{q_1} \rightarrow$ o/p



$\lambda : Q \rightarrow \Delta$

4(b)

	a	b
00	10	01
01	11	02
10	20	11
11	21	12
02	12	00
12	22	10
20	00	21
21	01	22
22	02	20

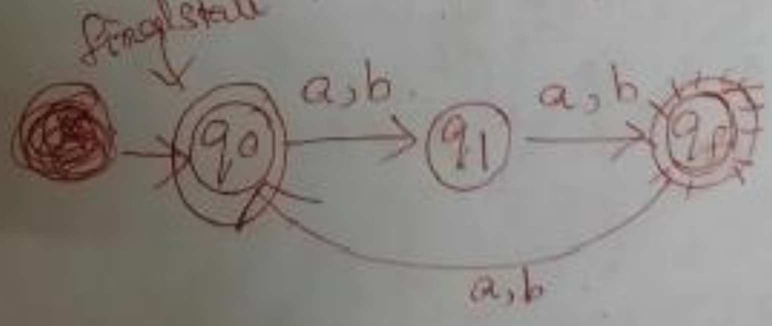
States = $\{ \ldots \}$.

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

$F = \{00, 11, 22\}$.

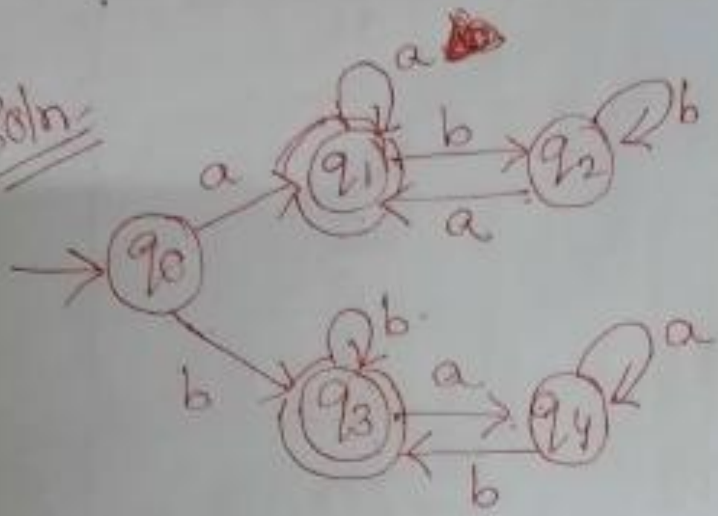
A : 69
B : 68
C : 66.

(2b) (i) $L = \{ w \in \{a,b\}^*, \forall x, y \in \{a,b\}^*, (|w| \% 3 = 0) \}$.



2b(ii) $L = \{ w \in \Sigma^* \mid w \neq \varepsilon$ and the first and last char of w are same $\}$

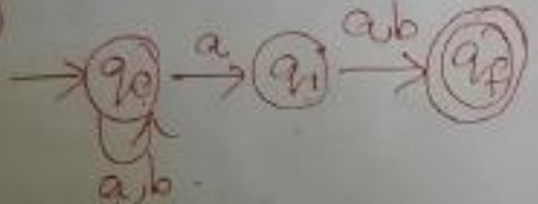
Soln



aabbaa

~~bbabab~~
bbabab
baab
bbbaaab

(5a)



(2nd part Q)

Soln
step 1

	a	b
$\rightarrow q_0$	$\{q_0, q_1\}$	$\{q_0\}$
q_1	q_f	q_f
q_f	ϕ	ϕ

NFA Transition table

Step 2 DFA Transition table

	a	b
$\rightarrow q_0$	$[q_0,q_1]$	$[q_0]$
$[q_0,q_1]$	$[q_0,q_1,q_f]$	$[q_0,q_f]$
$[q_0,q_1,q_f]$	$[q_0,q_1,q_f]$	$[q_0,q_f]$
$[q_0,q_f]$	$[q_0,q_1]$	$[q_0]$

$\delta([q_0,q_1],a)$
$= \delta(q_0,a) \cup \delta(q_1,a)$
$= [q_0,q_1] \cup [q_f]$
$= [q_0,q_1,q_f]$

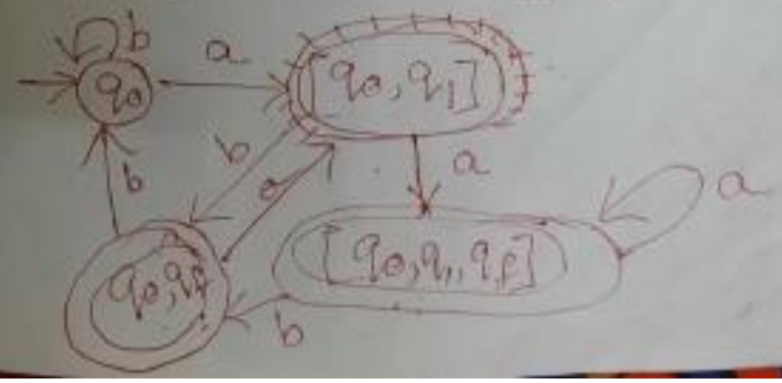
$\delta([q_0,q_1],b)$
$= \delta(q_0,b) \cup \delta(q_1,b)$
$= [q_0] \cup [q_f]$
$= [q_0,q_f]$

$\delta([q_0,q_1,q_f],a)$
$= [q_0,q_1] \cup [q_f] \cup \phi$
$= [q_0,q_1,q_f]$

$\delta([q_0,q_1,q_f],b)$
$= [q_0] \cup [q_f] \cup \phi$
$= [q_0,q_f]$

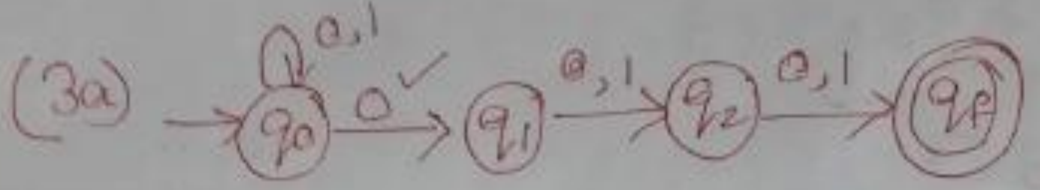
$\delta([q_0,q_f],a)$
$= [q_0,q_1] \cup \phi$
$= [q_0,q_1]$

$\delta([q_0,q_f],b)$
$= [q_0] \cup \phi$
$= [q_0]$



IAT 1 Solution.

(3a)



3rd symbol from Rt is 0.

(3b) $L = \{001, 10, 111\}$.

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

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

$L.M = \{001, 10, 111, 001001, 10001, 111001\}$

$L \cap M = \{001\}$.

$L - M = \{10, 111\}$.

$M - L = \{\varepsilon\}$.

$L^* = 001, 11110, \varepsilon$ (when $L = \{0, 11\}$

= {Strings of 0 and 1 such that 1 come in pairs}.

01011 ×

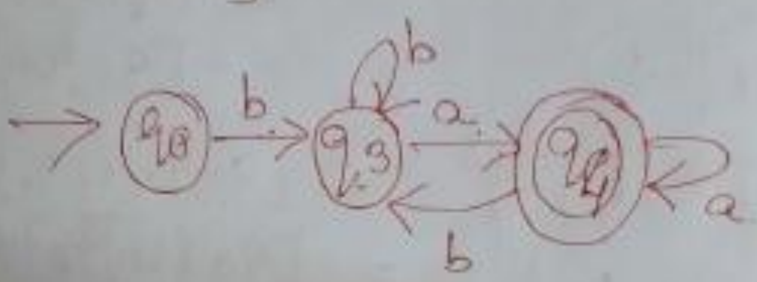
101 ×

L^* = {all strings of 0's & 1's}.
when $L = \{0, 1\}$

(6a) $L_1 = \{$starts with a and ends with b$\}$.

DFA =

$L2 = \{$starts with b and ends with a$\}$.



$\therefore L = L1 \cup L2$ (Answer)

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