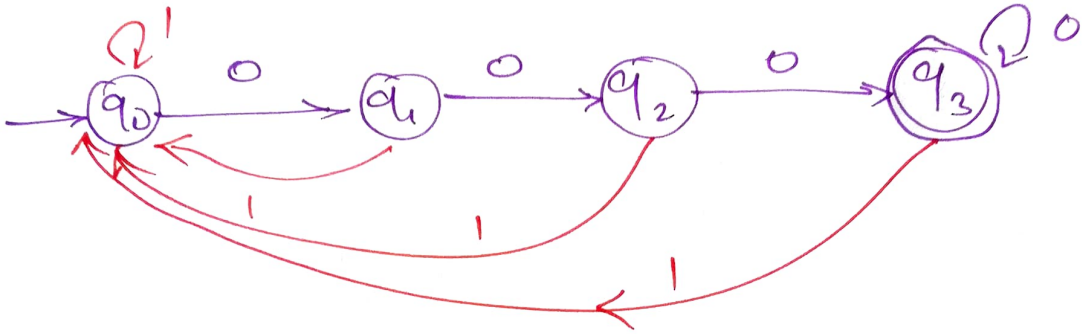
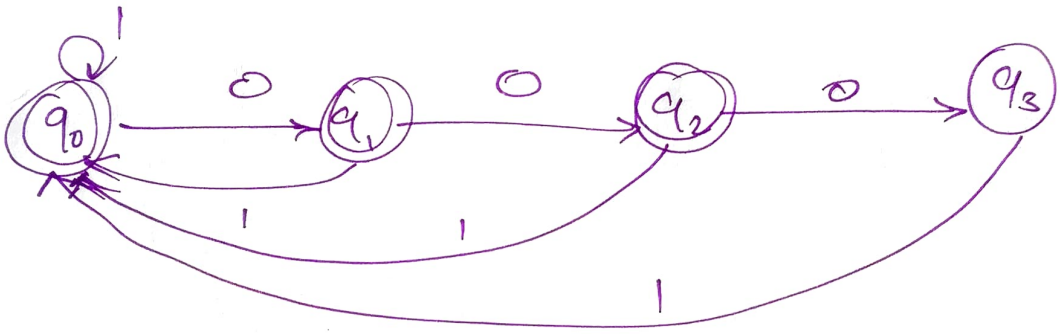
41) Construct min. FA. that contains 0 & 1 where every strings do not end with 000

→ $w = x000$



Now take complement



42) Give DFA, $\Sigma = \{0, 1\}$

(a) Number of 1's is multiple of 3 $0 \pmod 3$

(b) No. of 1's is not multiple of 3

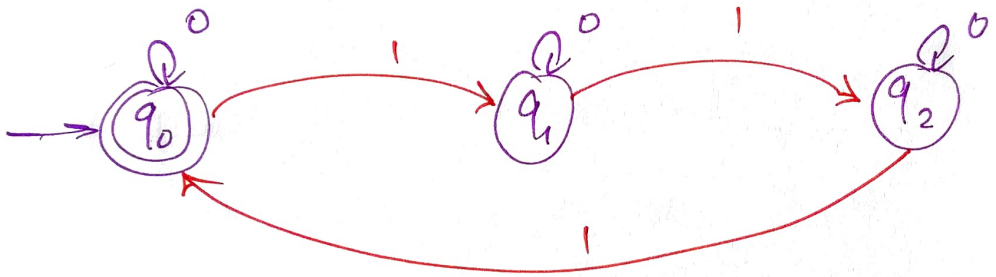
0	1	2
q_0	q_1	q_2

→ (a) (i) $3n$, $3n+1$, $3n+2$
0 1 2

A/c i/p is '1' will cause a transition from

q_0 to q_1 if M/c is in q_0
q_1 to q_2 — " — in q_1
q_2 to q_0 — " — in q_2

A/c i/p is '0' will not cause any transition



- Zero no. of 1's implies that no. of 1's is of the form $3n$. $= (3 \times 1 + 0) = 3$ // $\Rightarrow 3/3 = 0$

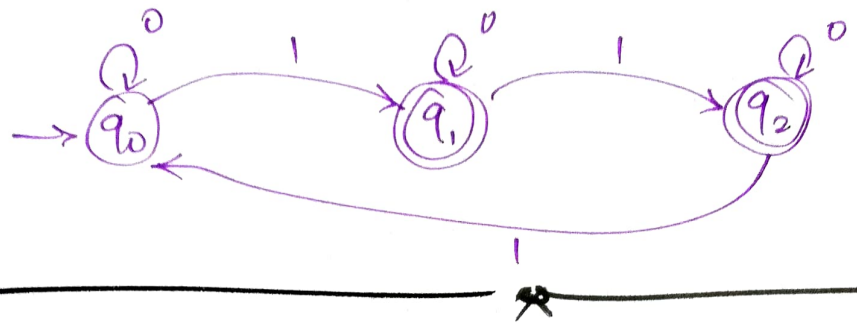
$3n+1 = (3 \times 1 + 1) = 4 \Rightarrow 4/3 = 1$

$3n+2 = (3 \times 1 + 2) = 5 \Rightarrow 5/3 = 2$

- 0101011 => q_0
- 01010101 => q_1
- 01101101 => q_2

δ	0	1
→ q_0	q_0	q_1
q_1	q_1	q_2
q_2	q_2	q_0

(b) No. of 1's is not multiple of 3.



δ	0	1
→ q_0	q_0	q_1
q_1	q_1	q_2
q_2	q_2	q_0

43) DFA accepting following language. $\Sigma = \{0, 1\}$

(a) No. of 1's is even & No. of 0's is even

(b) No. of 1's is odd & No. of 0's is odd.

⇒ (a) No. of 0's is even & no. of 0's is even
0 (mod 2) 0 (mod 2)

Situations		
No. of 0's	No. of 1's	State
Even 0	Even 1	q_0
Even 0	odd 1	q_1
odd 0	Even 1	q_2
odd 0	Odd 1	q_3

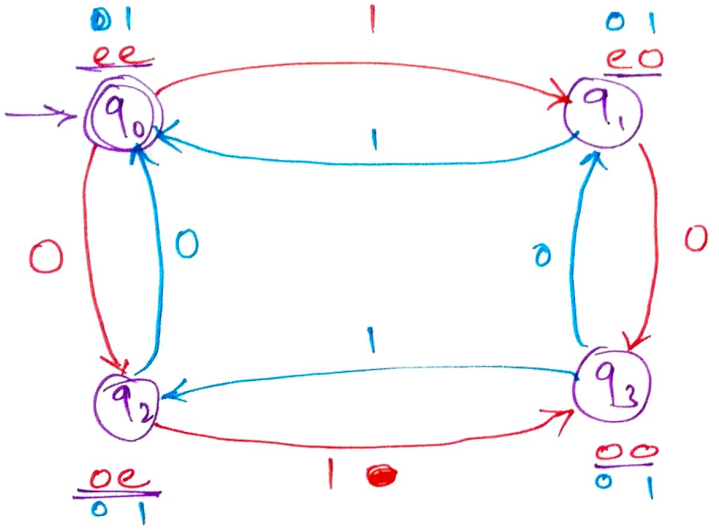
L = { 00, 11, 0101, 1010, ... }

'0' '1'

- Length '0' = 0/2 = 0 ; $q_2 = 0$ q_0

'1' = 0/2 = 1 ; 1/2 = 1 q_1, q_2

2 = 00/2 = 0 ; 11/2 = 0 q_0



$q_0 - q_2 \Rightarrow 0$

$q_0 - q_1 \Rightarrow 1$

$q_1 - q_0 \Rightarrow 11$

$q_1 - q_3 \Rightarrow 10$

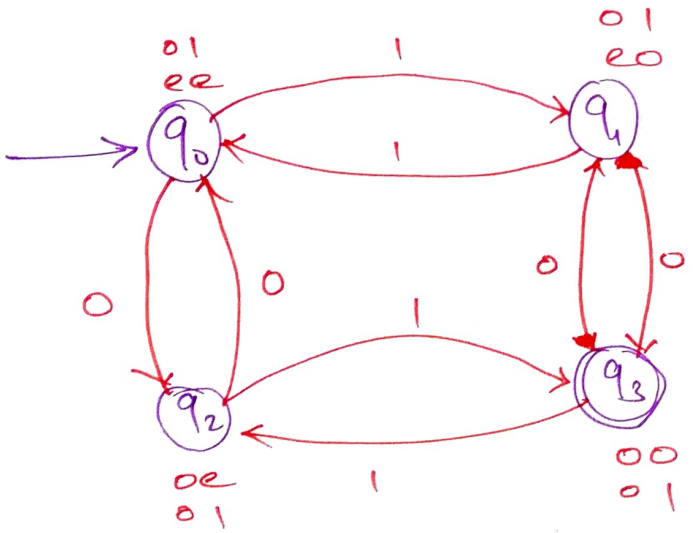
$q_2 - q_0 - 00$

$q_2 - q_3 - 01$

$q_3 - q_1 - 100/010$

$q_3 - q_2 - 011/101$

(b) No. of 1's is odd & No. of 0's is odd.



$L = \{ 01, 10, 1000, 0111, \ldots \}$

44) Even no.'s of 1's & odd no. of 0's

~~Even no. of~~

45) DFA reads the strings made up of letters in the word CHARIOT & recognizes these strings that contain the word (1) CAT as substring

(2) substring as RAT

→

46) Construct the minimal FA for the following language

(a) $L = \{ a^m . b^n \mid m, n \geq 0 \}$

→ $\Sigma = \{a, b\}$; $|\Sigma| = 2$

$a^m \; b^n$

$a^0 \; b^0 = \epsilon$

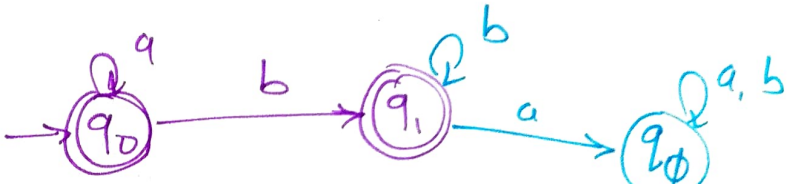
$a^1 \; b^0 = a$

$a^0 \; b^1 = b$

$L = \{ \epsilon, a^m, b^n, ab, aab, abb, \ldots \}$:

(i)

(ii)



No. of States = 2 + 1 = 3

(b) $L = \{ a^m . b^n . c^p \mid m, n, p \geq 0 \}$

→ $\Sigma = \{ a, b, c \} \Rightarrow |\Sigma| = 3$; $a^m \; b^n \; c^p$

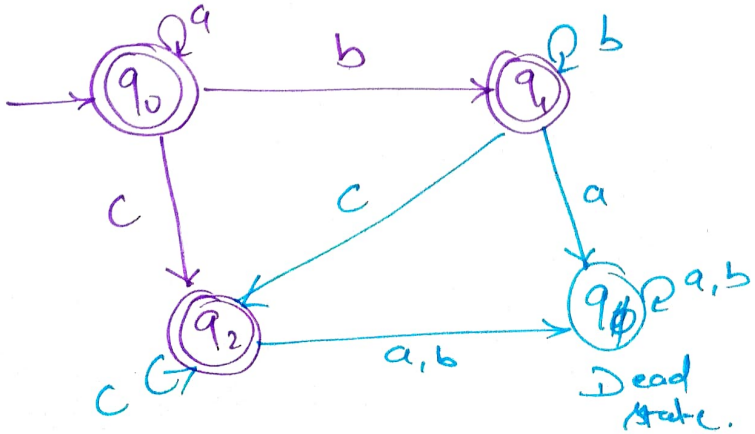
$a^0 \; b^0 \; c^0 = \epsilon$

$a^0 \; b^\phi \; c^0 = b$

$a^1 \; b^0 \; c^0 = a$

$a^0 \; b^0 \; c^1 = c$

$L = \{ \epsilon, a^m, b^n, c^p, a^m b^n, b^n c^p, a^m c^p, a^m b^n c^p, \ldots \}$



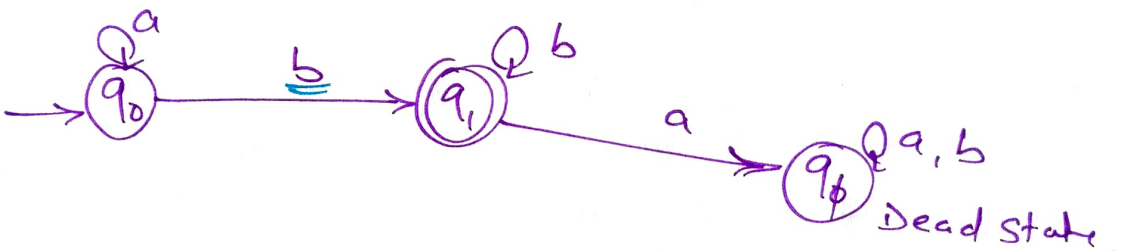
No. of States
= 3 + 1
= 4

(c) $L = \{ a^m b^n \mid m \geq 0, n \geq 1 \}$

$\Rightarrow$ $a^m b^n \Rightarrow a^0 b^1 \Rightarrow b^1$

$\therefore b^n \mid n \geq 1$

$L = \{ b, ab, aab, aabbb, \ldots \}$



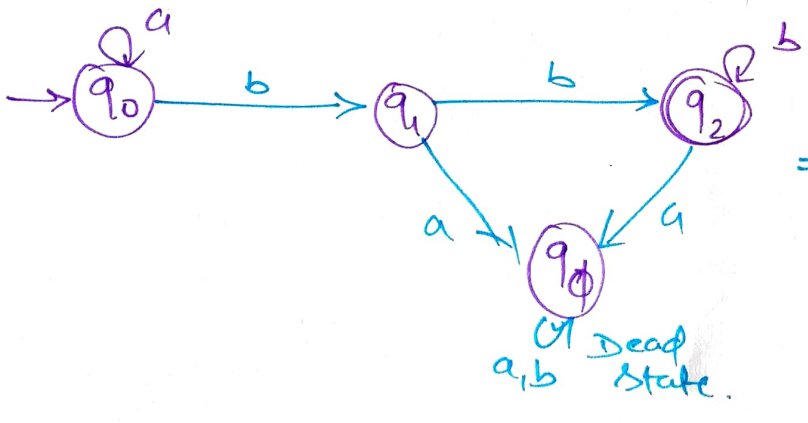
No. of States = Minimal length + 2 = 1 + 2 = 3

(d) $L = \{ a^m b^n \mid m \geq 0, n \geq 2 \}$

$\rightarrow$ $a^m b^n \Rightarrow a^0 b^2 \Rightarrow b^2$

$\therefore b^n \mid n \geq 2$

$L = \{ bb, abb, aabbb \ldots \}$



Minimal length.
$= m + n = 0 + 2 = 2$

No. of States
$= 2 + 2$
$= 4$