* **Productive States:-** The state that involves in the process of any valid input string is called as productive states.

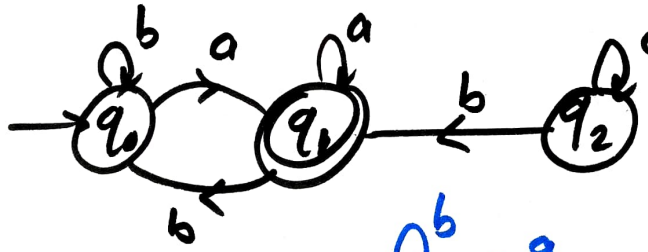
* **Non-Productive States:-** The state that doesnot involve in the process of any valid input string (or) whose presence (or) absence will not affect the language of FA is called as non-productive states.

Types of Non-productive states:-

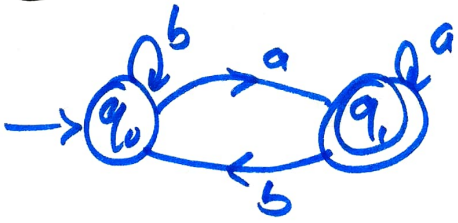
1) Unreachable state
2) Dead state
3) Equal state.

* **Unreachable State:-** The state that cannot be reached from initial state is called as unreachable state.

Ex:-



q_2 Unreachable State.



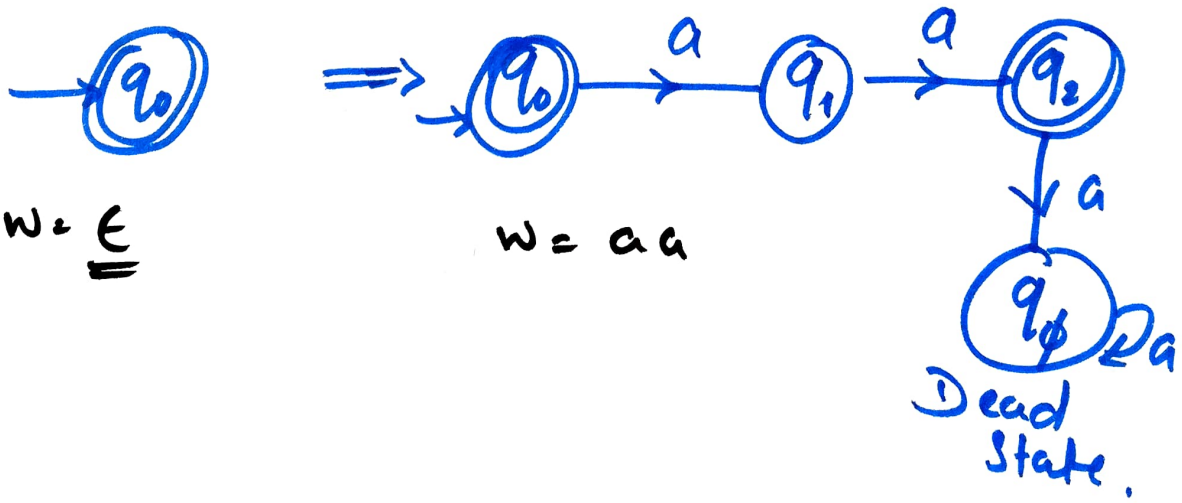
$w = Xa$

- Unreachable state can be final (or) nonfinal.

- On the removal of unreachable state there won't be change in the structure as well as language of FA. i.e. the resulting machine is also in DFA & accept the same language.

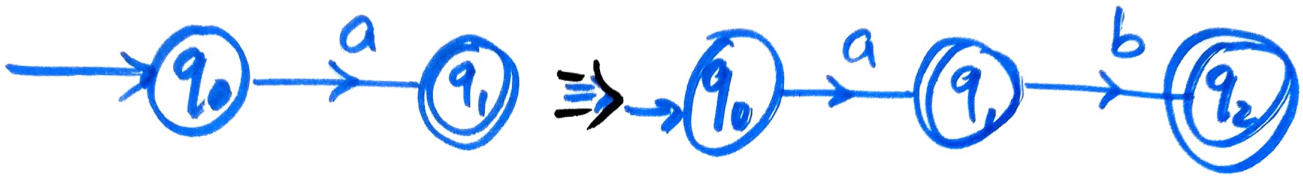
*Construction of Minimal FA for finite Language

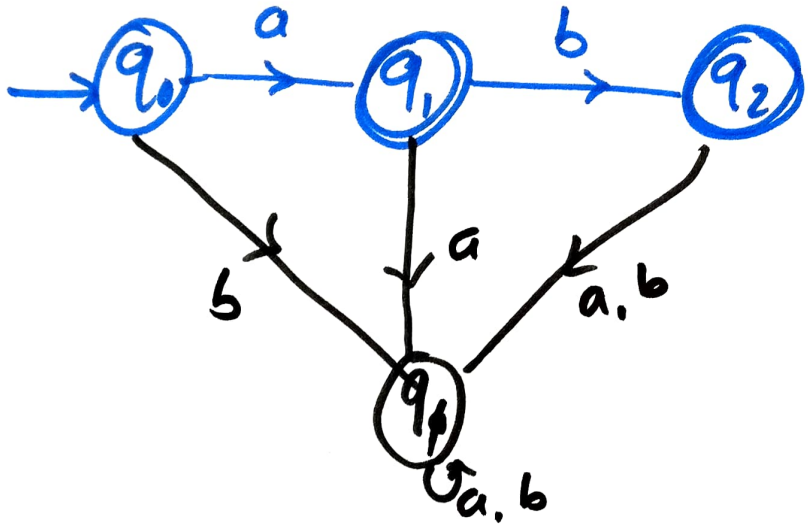
1) $L = \{\epsilon, aa\}$



2) $L = \{a, ab\}$ $\quad \Sigma = \{a, b\}$

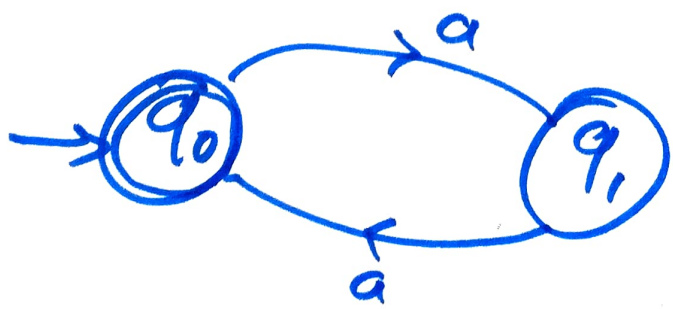
$\Sigma^* = \{\epsilon, a, b, \dots\}$





3) L = even no. of a's

$\Rightarrow \quad \Sigma = \{a\}$



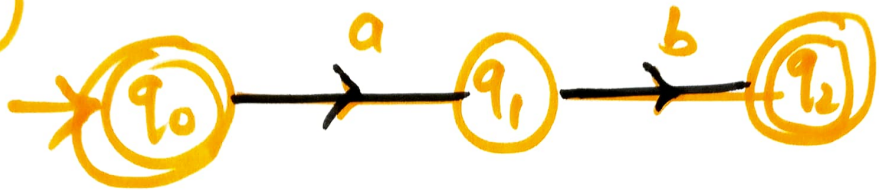
4) $L = \{\epsilon, ab, bab\}$ (0) (2) (3)

→ $\Sigma = \{a, b\}$ $\therefore \Sigma^* = \{\epsilon, a, b, aa, bb \ldots\}$

(1)

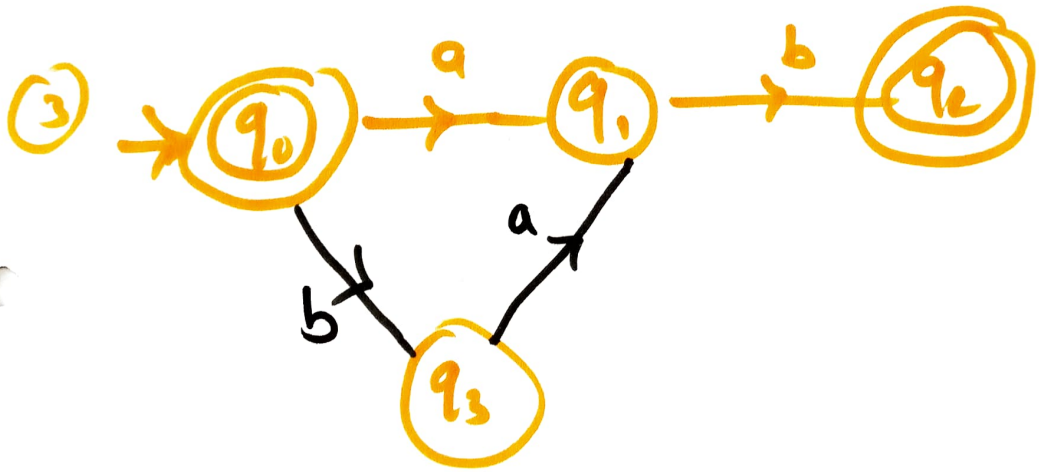
$\Sigma = \{\epsilon\}$

(2)

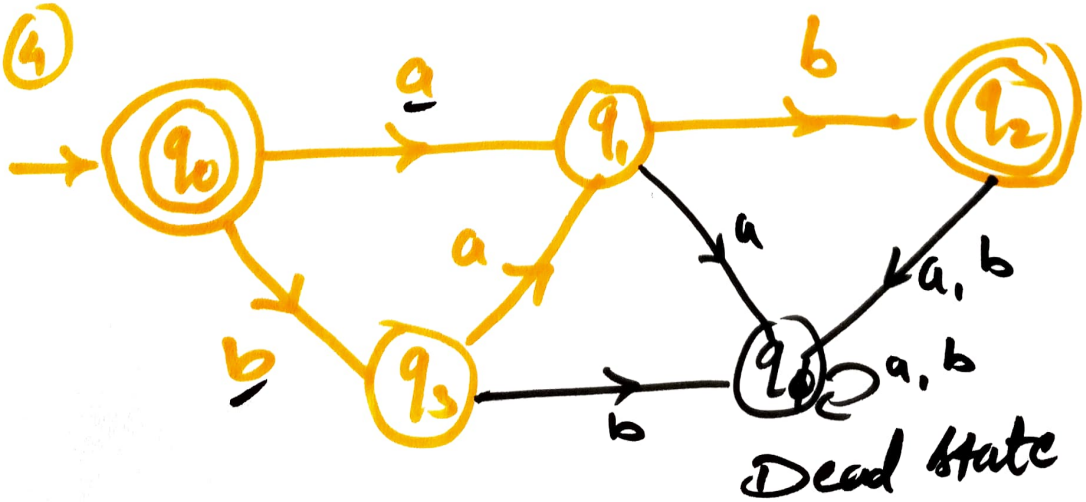


$\Sigma = \{a, b\}$

(3)



(4)



Dead state

Transition Table.

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

5) $L = \{ w \in \Sigma^* \mid |w| \leq 2 \}$, $\Sigma = \{a, b\}$

$\Rightarrow$ $|w| = 0, 1, 2$

$L = \{ \epsilon, a, b, aa, ab, ba, bb \}$

1) → q_0 $\Rightarrow \epsilon$

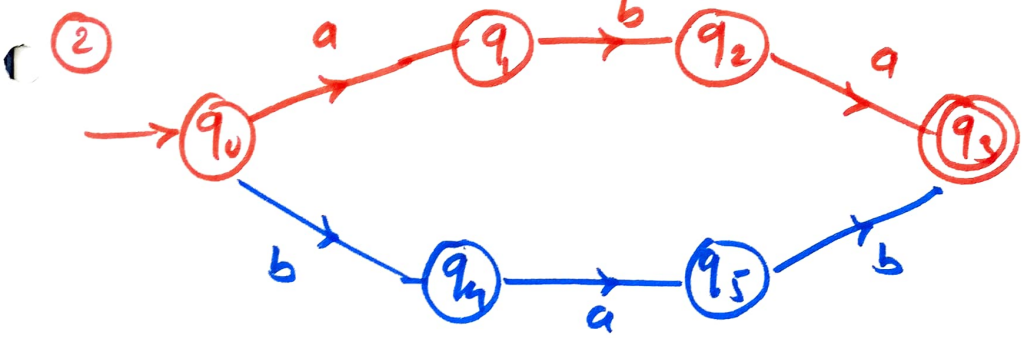
2) → q_0 —a,b→ q_1

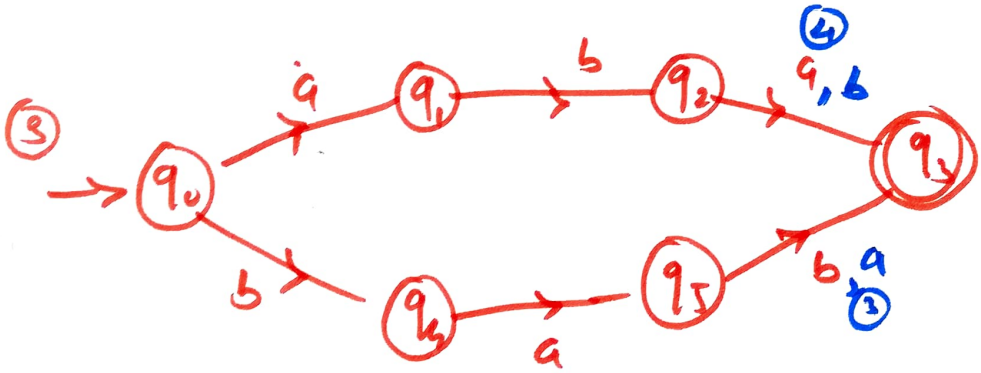
3) → q_0 —a,b→ q_1 —a,b→ q_2

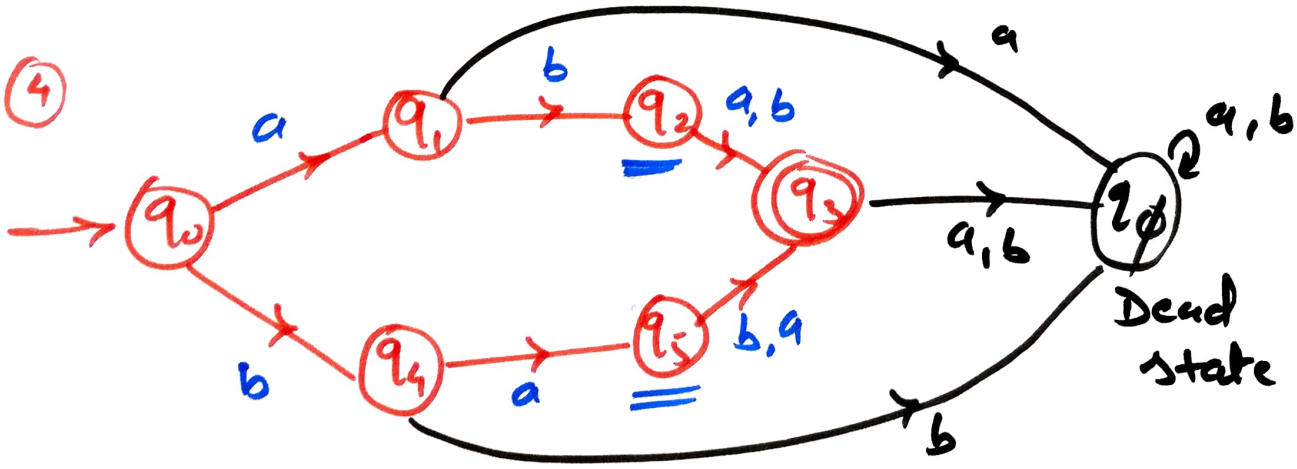
4) → q_0 —a,b→ q_1 —a,b→ q_2 —a,b→ q_ϕ (a,b) Dead state

6) $L = \{aba, bab, baa, abb\}$
① ② ③ ④

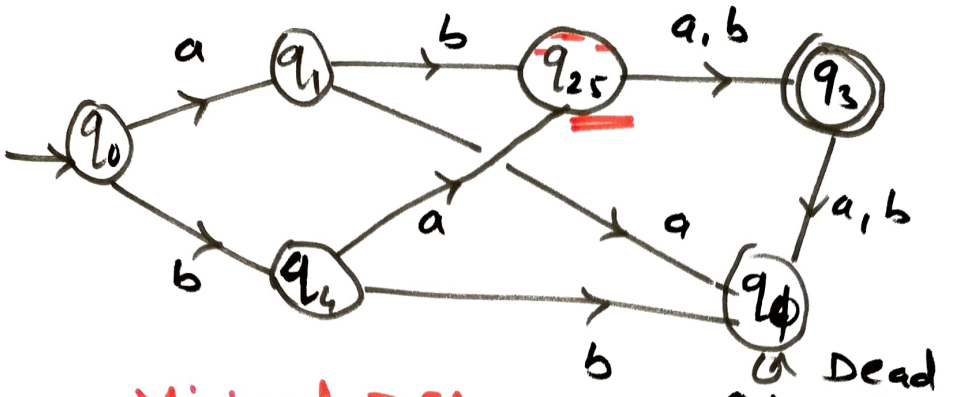
$\Rightarrow$







$q_2 = q_5$



Minimal DFA.

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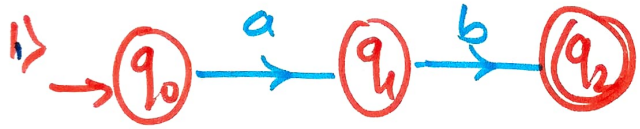
7) $L = \{ ab, abb, baa, aba \}$

(1) (2) (3) (4)

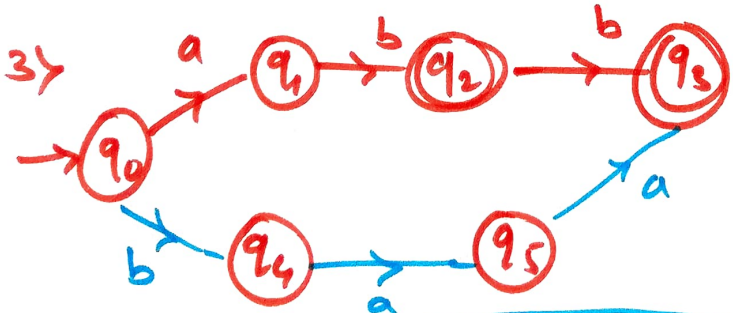
→ $\Sigma = \{a, b\}$

1)

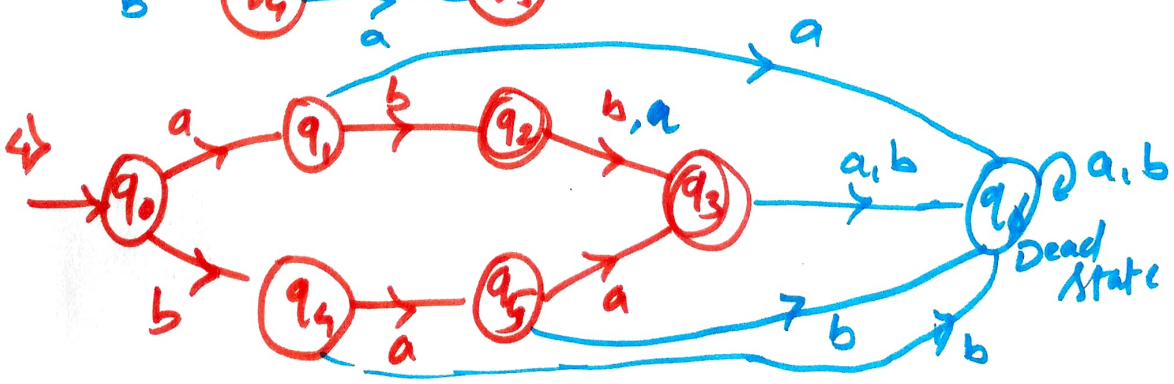


2)

3)



4)



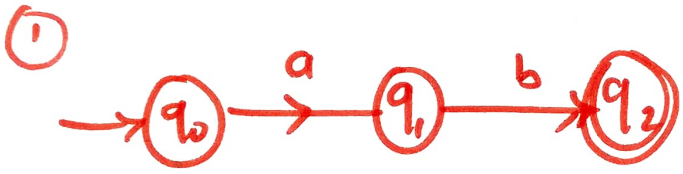
8) $L = \{ a^m b^n \mid m = n ;\ 1 \le m \le 2,\ 1 \le n \le 2 \}$

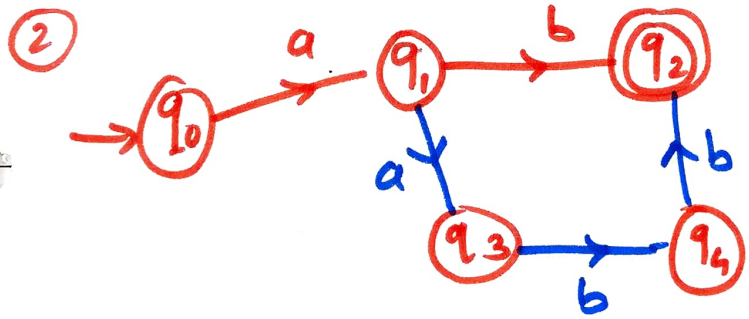
→ $m = n$ 11 (or) 22

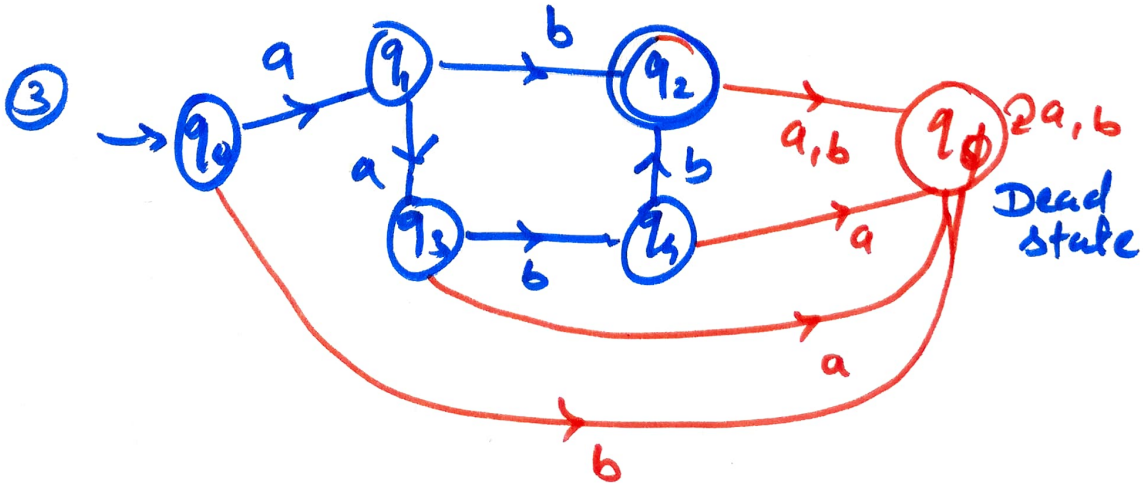
① $a^1 b^1 = ab$

② $a^2 b^2 = aabb$

$L = \{ ab, aabb \}$







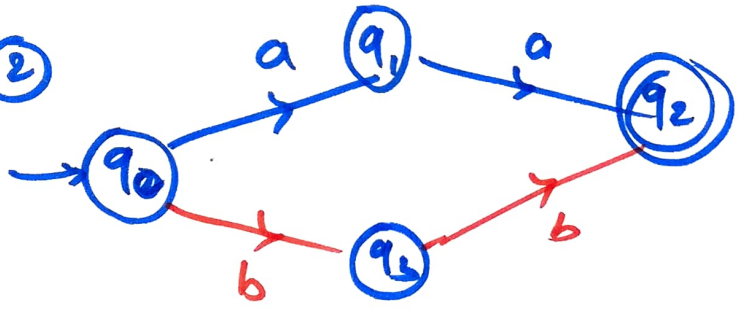
9) $L = \{a^m b^n / m+n = 2\}$; $m, n \geq 0$

→ $\left.\begin{matrix} 0+2 \\ 1+1 \\ 2+0 \end{matrix}\right\} L = \{bb, ab, aa\}$

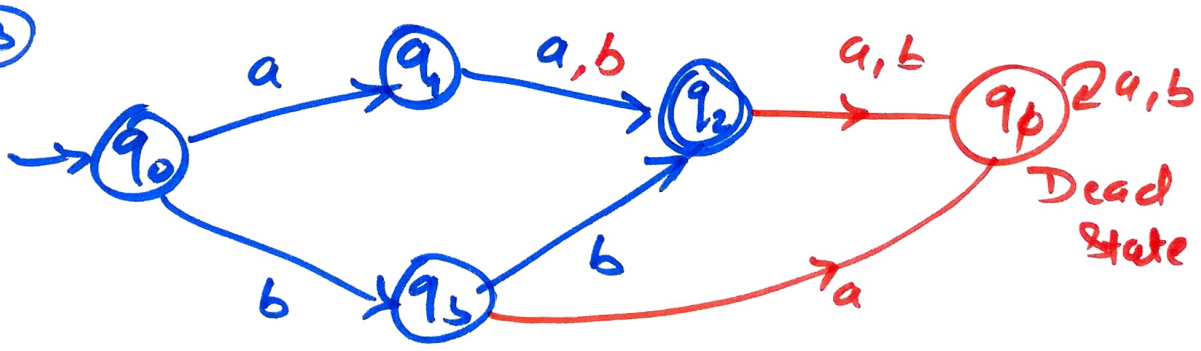
$a^0b^2 = \underline{bb}$; $a^1b^1 = \underline{\underline{ab}}$; $a^2b^0 = \underline{\underline{aa}}$

(1)

(2)



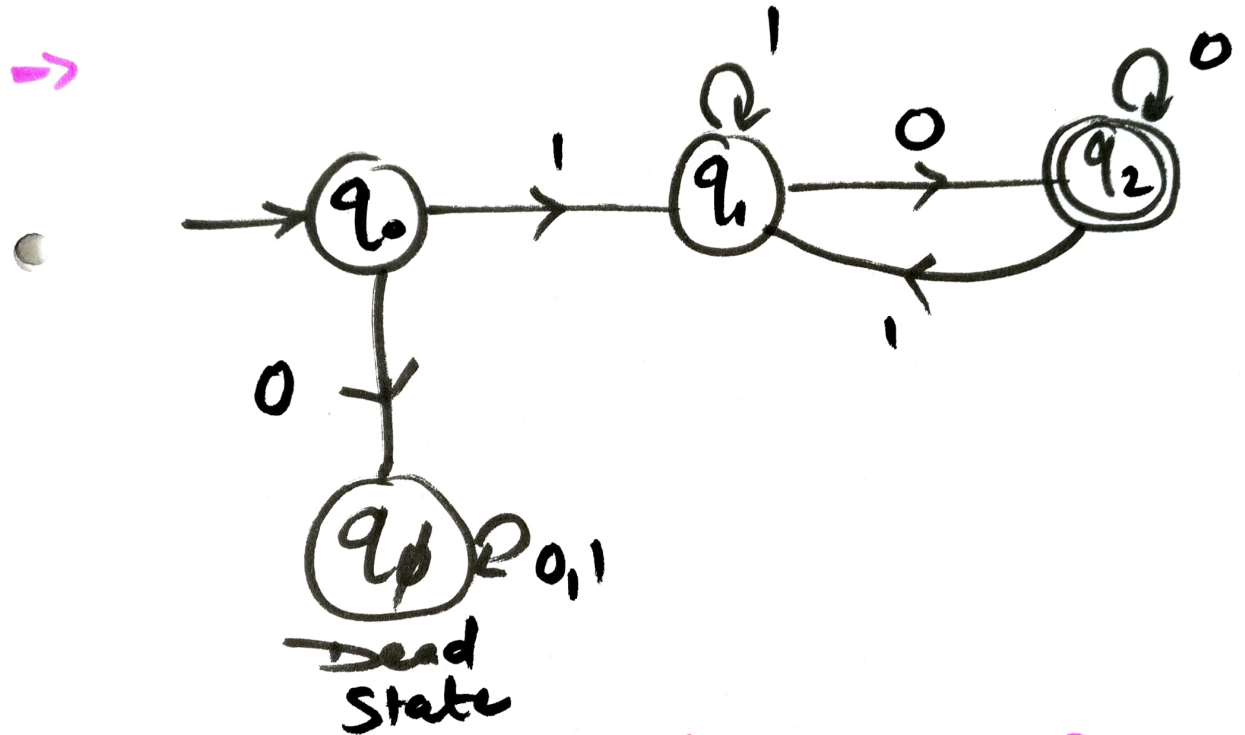
(3)

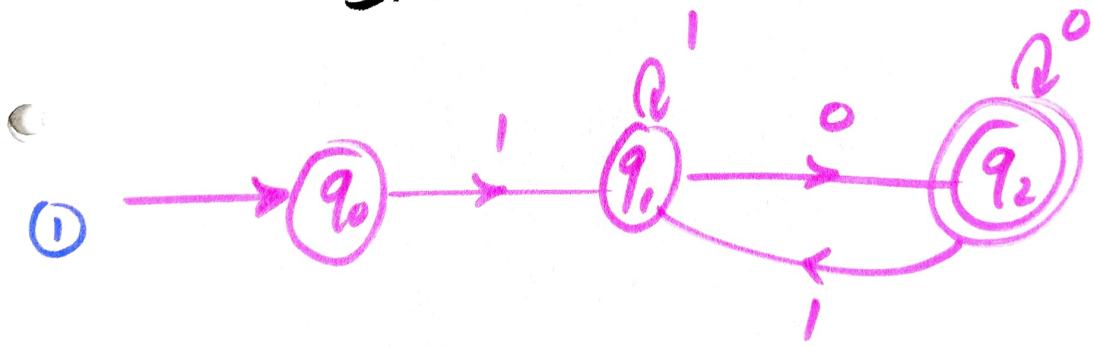


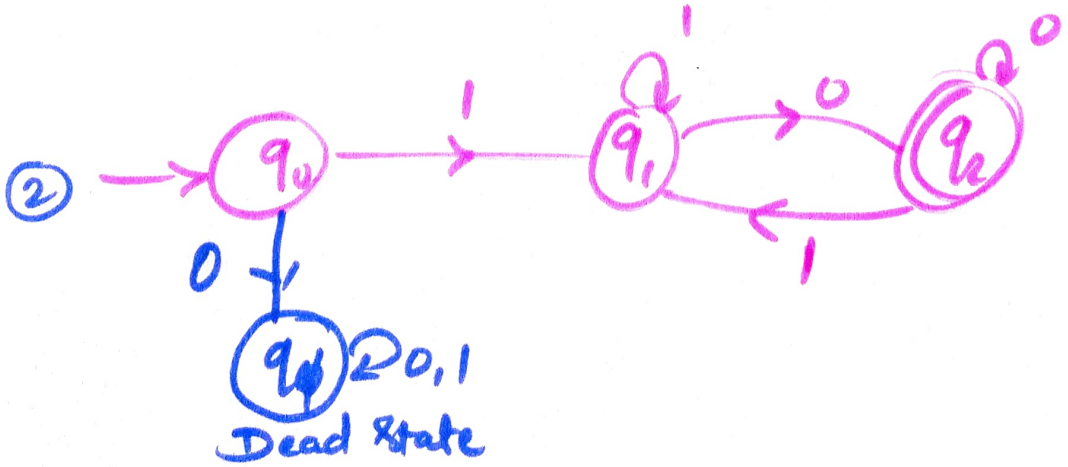
Q. 10) $\Sigma = \{0, 1\}$

$w = 1 \times 0$

$L = \{10, 110, 100, 1100, 1010, 1000, \cdots\}$

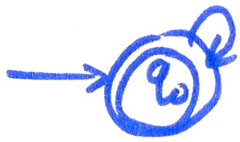






11) $\Sigma = \{0, 1\}$; Including ϵ

$L = \Sigma^* = \{\epsilon, 0, 1, \ldots\}$



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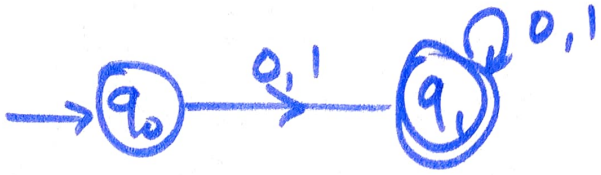
12) $\Sigma = \{0, 1\}$; Excluding ϵ

$L = \Sigma^+ = \{0, 1, 00, 01, 10, 11, \ldots\}$

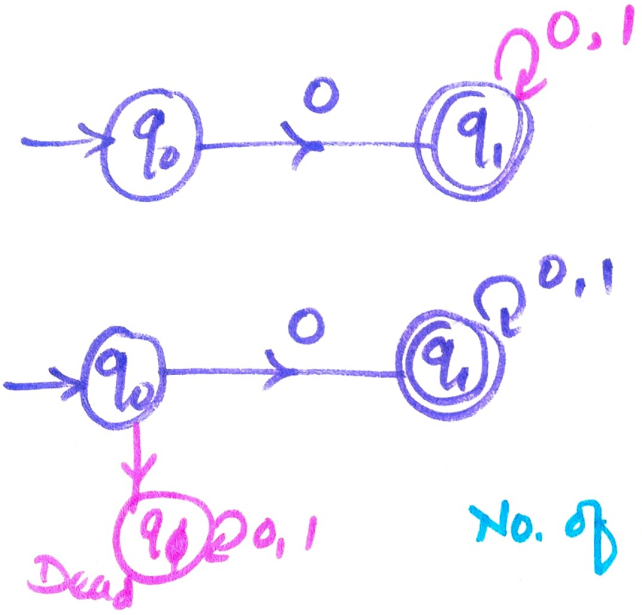


13> Minimal FA that accepts all the strings of 0's & 1's that every string starts with –

a> 0 b> 10 c> 010

⇒ (a) $\Sigma = \{0, 1\}$ $W = 0X$

$L = \{0, 00, 01, 011, 010, 0001, \ldots\}$

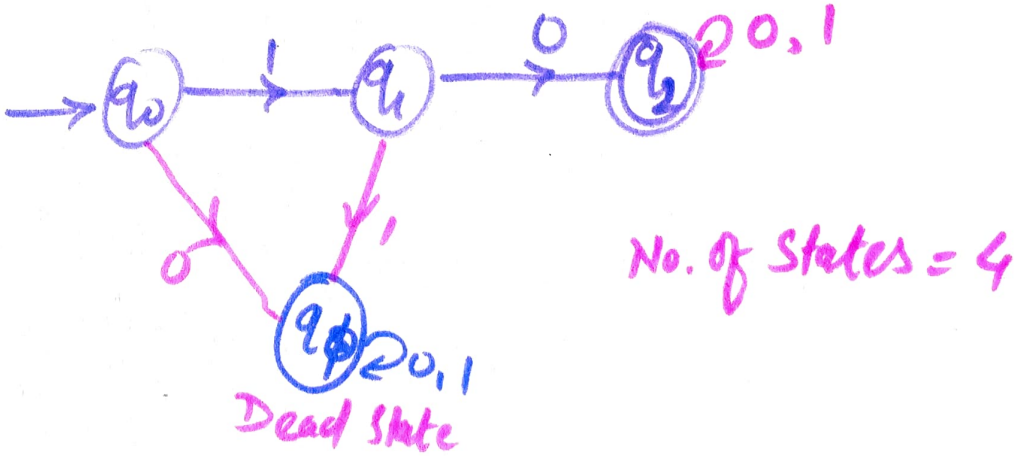


δ	0	1
$\rightarrow q_0$	q_1	q_ϕ
(q_1)	q_1	q_1
q_ϕ	q_ϕ	q_ϕ

No. of states :- 03

(b) $\Sigma = \{0, 1\}$; $W = 10X$

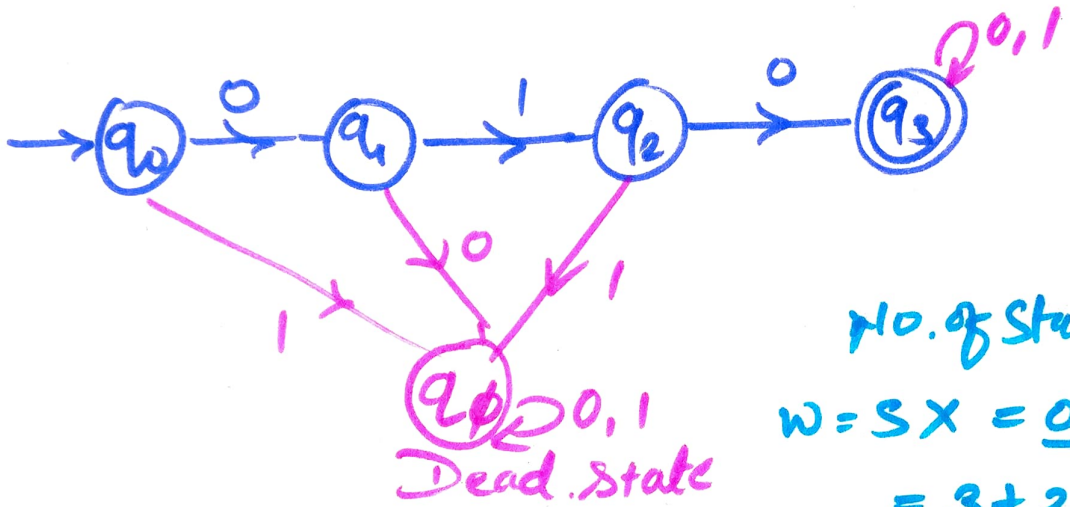
$L = \{10, 101, 1010, 100, 1011, \ldots\}$



No. of States = 4

© $\Sigma = \{0,1\}$; $w = \underline{010}x$

$\Rightarrow$ $L = \{010, 0101, 0101, 0100, 01011 \ldots\}$



No. of States = 5

$w = Sx = \underline{010}x$

$= \underline{3+2} = \underline{5}$

Note:- $w = \underline{Sx}$; $\underline{|S| = n}$ then no. of states in minimal FA to accept the language is $\boxed{\underline{n+2}}$