Lecture 5:-

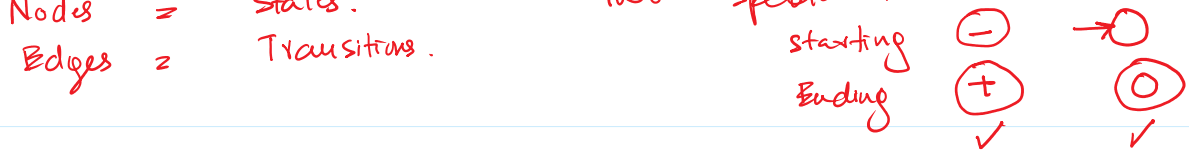
Deterministic Finite Automata.

- Finite State Machine.
- Transition table, Directed Graph.

Nodes = States.
Edges = Transitions.

two Special Nodes.

starting (−)
Ending (+)



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

aab
1 1 2 3

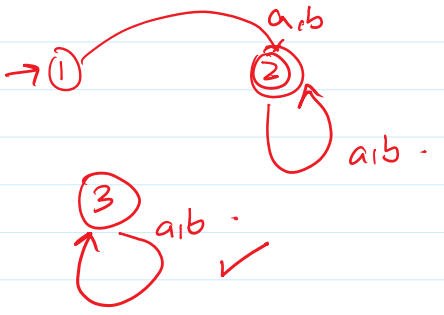
a
1

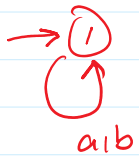
aabbbbbaab ✓
1 2 3 3 3 3 3 3 3

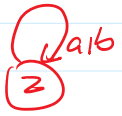
$L = \{aaa, aab, aba, abb, baa, \dots\}$.

abbbab.
1 2 3 3 3 3 ✓

Are these FA's. $\Sigma = \{a, b\}$.





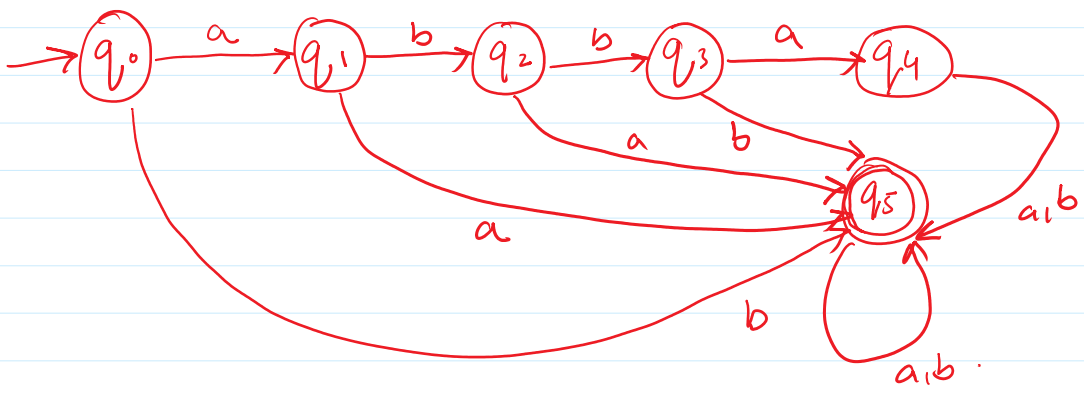


Formal Definition:-

$$M = (Q, \Sigma, \delta, q_0, F).$$

Q = Set of States
Σ = Set of Alphabets

δ = transition fn.
q_0 = Initial State
F = Set of accepting states.



$Q = \{q_0, q_1, q_2, q_3, q_4, q_5\}$. $\quad \Sigma = \{a, b\}$.

$\delta : Q \times \Sigma \to Q$.

$\delta(q_0, a) \to q_1$.

$F \subseteq Q$

Extended transition Function.

$\delta^* : Q \times \Sigma^* \to Q$.

$(q_0, aabbaab) \to q_5$.

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

$Q = \{q_0, \ldots q_5\}$.

$\Sigma^* = \{\lambda, a, b, \ldots\}$.

$\delta^*(q_0, \lambda) = q_0$.

$(q_0, \lambda), (q_0, a)$

$(q_0, aabbaab)$.

In general

$$\delta^*(q, w) = q'.$$

$$L(M) = \{w \in \Sigma^* : \delta^*(q_0, w) \in F\}.$$

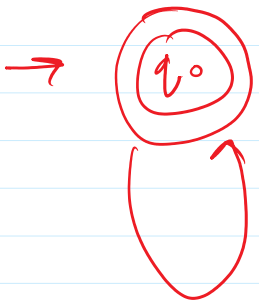
Language Rejected

$\overline{L(M)} = \{ w \in \Sigma^* : \delta^*(q_0, w) \notin F \}$.

Ex 1:- $\Sigma = \{a, b\}$.

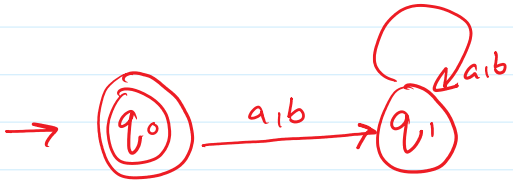
$L(M) = \{\}$.

Ex:- $\Sigma = \{a, b\}$.



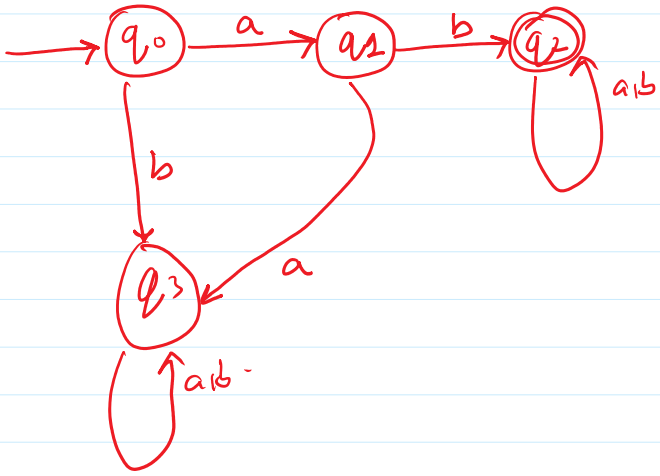
$L(M) = \Sigma^*$

Ex 3:-



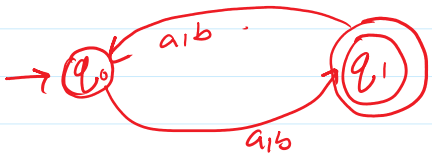
$L(M) = \{\}$.

Ex 4:- All strings beginning with ab. $\Sigma = \{a, b\}$.



Ex. Language of odd length Strings.

$((a+b)(a+b))^*(a+b)$.

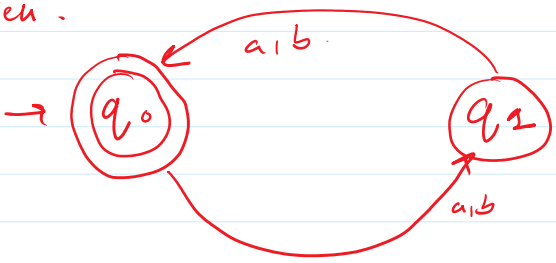


a|b

aaa, aab.

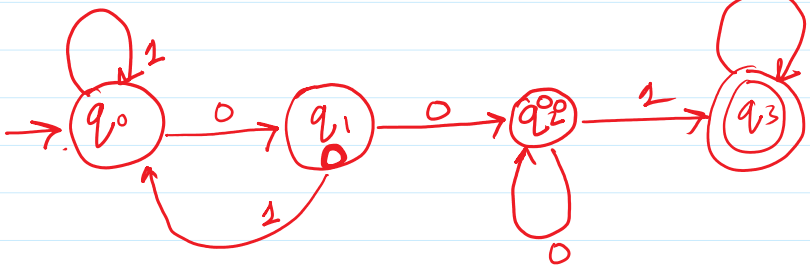
$q_1 q_0 q_1$ $q_1 q_0 q_1$

Even.



Ex:- $\Sigma = \{0, 1\}$.

All strings Containing Substrings 001.



0010000 ✓

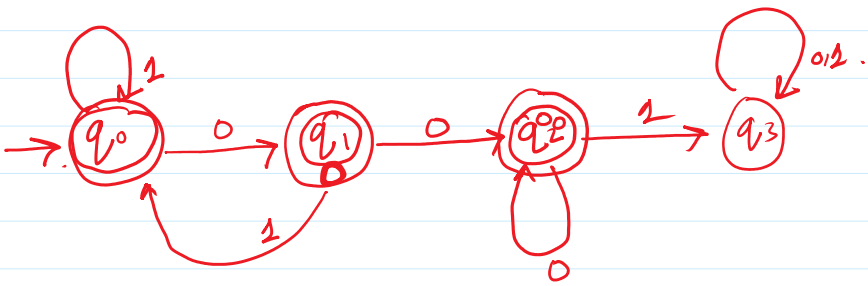
00100001 ✓

00010000 ✓

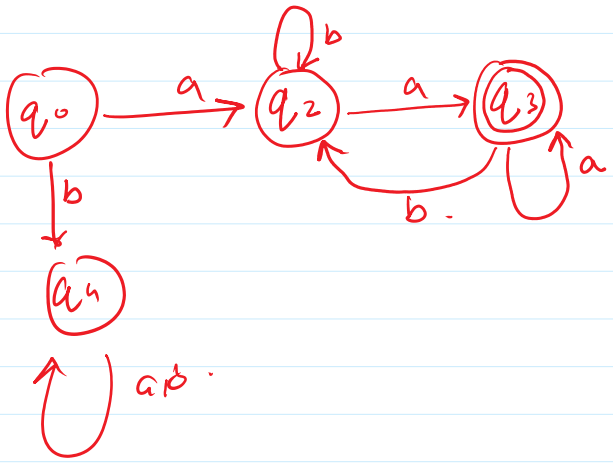
01

000000

A Language which does not Contain 001.



$L(M) = \{ awa, \ w \in \Sigma^* \}$. $\Sigma = \{a, b\}$.



aba.
abx.
abba.
aaba. ✓.

a bbbbbbbba ✓

Quiz #1 07 - Sep - 2022.

Construct FA for a language containing aa. $\Sigma = \{a, b\}$.