Theory of Comp.

$L_1 = \{ x \mid x \in \{0,1\}^* \; x \text{ ends with } 01 \}$

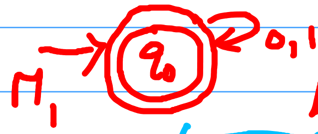
$L_2 = \{ x \mid x \in \{0,1\}^* \; x \text{ begins with } 10 \}$

$\Sigma = \{0,1\}$

$\Sigma^* =$ Set of all strings over $\{0,1\}$

$\hookrightarrow \{ \epsilon, 0, 1, 00, 01, \ldots \}$

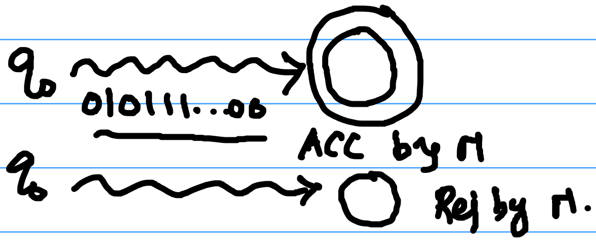
① ? FSA Accepting Σ^*



$L(M_1) = \Sigma^*$

Set of all strings ACC by M_1

M_1 — Must Accept L
— Must Reject $\Sigma^* \setminus L$



$\Sigma^* = \{ \epsilon, 0, 1, 00, 01, \ldots$

$L(M)$: The language Acc by FSA 'M'

$\hookrightarrow$ The set of strings x

$$L(M) = \{ x \mid \underbrace{\delta(q_0, x)} = q_f \in F \}$$

M: Set of strings ending with 01

$L(M) = \{ 01, 001, 101, 1101, 0101, \ldots$

Essentially: $L(M) \subseteq \Sigma^*$

$\uparrow$ a subset

① Given an arbitrary subset $S \subseteq \Sigma^*$,

Does $\exists$ FSA M accepting S.

1) $\cdots 01$

2) $10\cdots$

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

$\delta(q, 0) = q'$

$\delta(q_0, 0) = q_0$

$\delta(q_0, \overline{010011}^{x})$

$= \delta(\delta(q_0, 0), 10011)$

$= \delta(\delta(\delta(\delta(q_0, 0), 1), 0) \ldots$

$\delta(q_0, 1100) = \delta(\delta(\delta(\delta(q_0, 1), 1), 0), 0 \ldots$

$\delta(q, 0)$

$\hat{\delta}(q, x)$

$\hookrightarrow x \in \Sigma^*$

δ: Simulation on a symbol

$\hat{\delta}$: " a string

$$\hat{\delta}(q, x) \qquad x = x_1 x_2 x_3 \ldots$$

$$= \delta(\delta(\delta(q, x_1), x_2), \ldots)$$

$L = \{ x \mid x \in \{0,1\}^* \; x \text{ contains } 101 \text{ as a substring} \}.$

Text Books /
1. class notes
2. Hopcroft & Ullman
   - DS
   - Algo
   - OS, CN, DB, Arch
3. Peter Linz

Theory of Comp.
Lang, Machines, Computation
Automaton theory

- 25 Marks : Midsem
- 50 Marks : End Sem
- 25 Marks : Assignment
  Online
  24 hrs

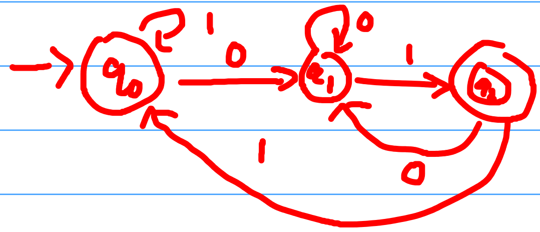
1) Internet
2) Friends
3) Seniors/Peers

$\delta :\quad \delta(q, \underset{\in \Sigma}{a}) = q' \in Q$

$\hat{\delta} :\quad \hat{\delta}(q, \underset{\in \Sigma^*}{x})$

$x = x_1 x_2 x_3 \ldots$

q



$\hat{\delta}(\delta(q_1, 1), 1001)$

$\hat{\delta}(q_2, 1001)$

$\hat{\delta}(\delta(q_2, 1), 001)$

$\vdots$

$x = 011001$

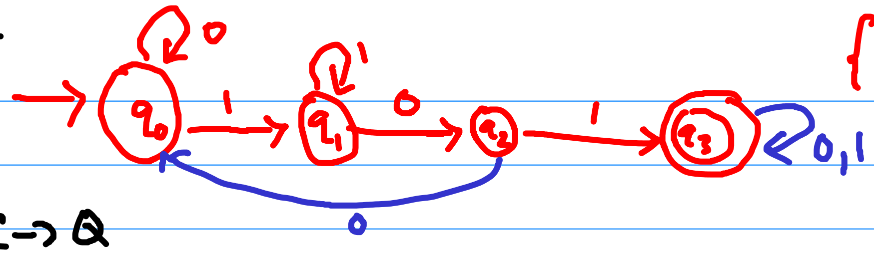
$\delta(q_0, 0) = q_1$

$$\hat{\delta}(q_0, 011001)$$

$$= \hat{\delta}(\delta(q_0, 0), 11001)$$

$$= \hat{\delta}(q_1, 11001)$$

$L_3 : \{ x \mid x \in \{0,1\}^*$ x contains 101 as a substring $\}$.



{ 101, 0101, 1101, 10100, ...

000111101

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

$\{q_0, q_1, q_2, q_3\} \times \{0,1\} \to$

$q_0, 0 \longrightarrow ?\ q_0$

$q_0, 1 \longrightarrow q_1$

$q_1, 0 \longrightarrow q_2$

$q_1, 1 \longrightarrow q_1$

$q_2, 1 \longrightarrow q_3$

$q_2, 0 \longrightarrow ?$

x

$\underbrace{\text{prefix}}\ 101\ \underbrace{\text{suffix}}$

q_0, q_1, q_2 ; q_3

If $\delta(q_2, 0) = q_2$ then 011001 is Acc by M Incorrect

If $\delta(q_2, 0) = q_1$ then 10001 is Acc by M Incorr

$\delta(q_2, 0) = q_0$

$x \in \{0,1\}^*$

$L_4 = \{ x \mid x$ begins with 00 ends with 01 $\}$

Einstein ? A good Q

— Q_1

Q_2

⋮

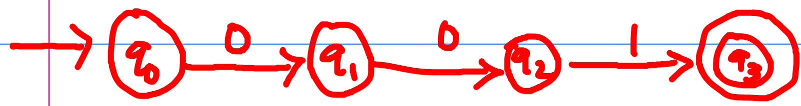
really Q

⋮

outst Q.

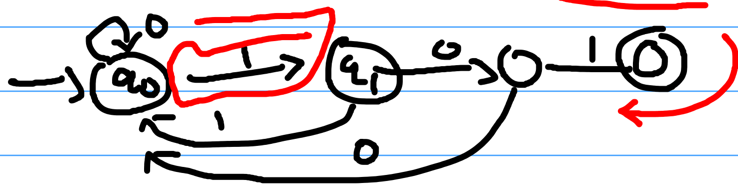
001, 0001, 00 11 00 0110 01

$00\,\underbrace{\text{Any st over } \{0,1\}}\,01$

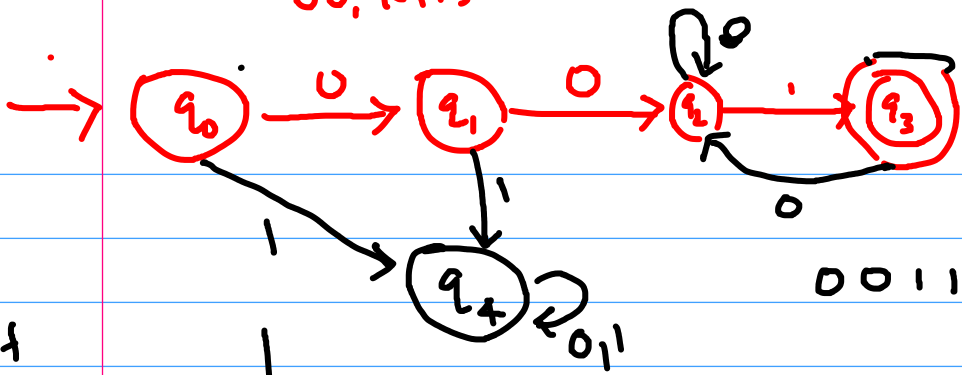


101 as a substring

1101 =



$00,\{0,1\}^*$ . .



001101

0011 is Acc ×

00111 is Acc ×

0011101

— — q_4

If $\delta(q_3,\epsilon)=q_3$

$\delta(q_3,0)=q_1$

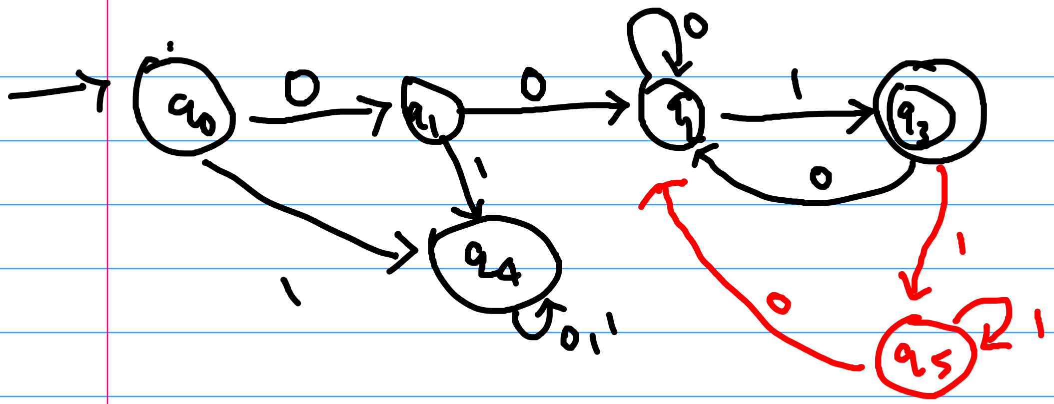
0010 $\in L(M)$ - Incorrect.

$\hat{\delta}(q_1, 00101) = q_4 \notin L(M)$

Invalid st

1	$\{0,1\}^*$
01	$\{0,1\}^*$
11	
10	

begins with 00 ... ends with 01

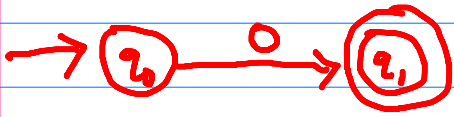


$L_5 = \{ x \mid x \in \{0,1\}^*$ x Contains odd no. of 0's and Even no. of 1's $\}$.

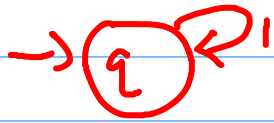
$L_5 = \{ x \mid x \in \{0,1\}^*$ s.t. $\#_0(x) : \text{ODD} \wedge \#_1(x) : \text{Even} \}$.

ODD $\#_0$ ← No. of 0   Even $\#_1$

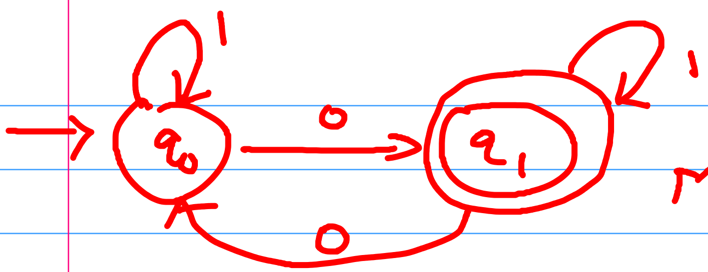
$L_5 = \{ 0, 011, 101, 110, 000, 00011, 10100, \ldots$



The FSA M cannot have self loops @ any state if M exists.



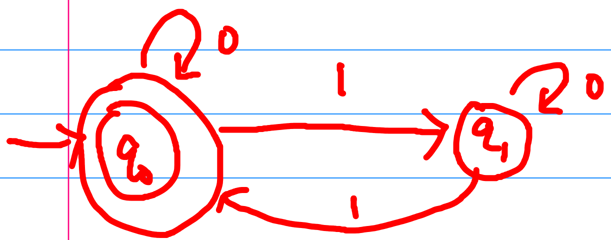
– No control over the $\#_1$'s read by FSA.



M_1

L_1 ODD no. of 0's

No Constraint on $\#_{1's}$



M_2

L_2 Even no. of 1's

No Const on $\#_{0's}$

L_5: ODD $\#_0 \wedge$ Even $\#_1$

$= L_1 \cap L_2$