

22/03/22

FLAT

Tutorial - 1

- 1) Design a FSM for string which accepts set of all strings on $\Sigma = \{a, b\}$ with no more than 3 a's
- 2) Design a ^{FSM}~~DFA~~ that accepts the language
 $L = \{w \in (0, 1)^* \mid \text{second symbol is } 0^* \text{ and fourth symbol is } 1\}$
- 3) Design a FSM that accepts the language
 $L = \{(01)^i 1^j \mid i, j \geq 1\}$
- 4) Design a FSM that accepts the language
 $L = \{abwba \mid w \in \{a, b\}^*\}$
- 5) Write R.E for the set of strings of 0's and 1's not containing 101 as a substring.
- 6) Write R.E for the language
 $L = \{a^n b^m \mid n \geq 4, m \geq 3\}$

Solutions:

→ 1) Step 1:

$X = \{Q, F, \epsilon, \delta, q_0\}$

Q: Total number of states = 5

F: Final state = $q_s, q_a, q_{aa}, q_{aaa}$

$\epsilon: \{a, b\}$

δ : Transition state

q_0 : Initial state = q_s

Step 2: Logic

q_s : start state

q_a : String containing 1 a

q_{aa} : String containing 2 a

q_{aaa} : String containing 3 a

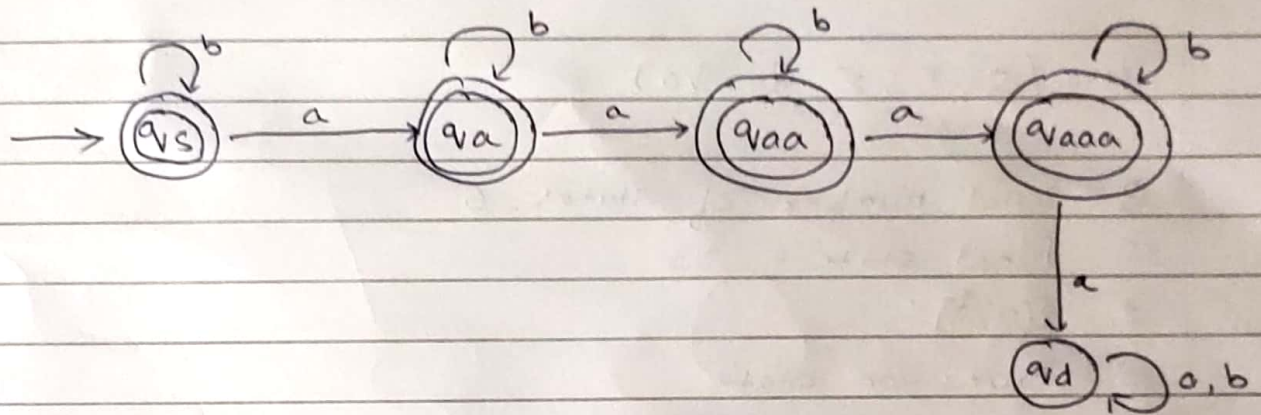
q_b : String containing 1 b

q_d : dead state

Step 3: Transition Table

$Q \backslash \epsilon$	a	b
$\rightarrow q_s^*$	q_a	q_s
q_a^*	q_{aa}	q_a
q_{aa}^*	q_{aaa}	q_{aa}
q_{aaa}^*	q_d	q_{aaa}
q_d	q_d	q_d

Step 4: Transition diagram



Step 5 : Simulation

Example:

$(q_s, abaa\ bb)$

$\vdash (q_a, baa\ bb)$

$\vdash (q_a, aa\ bb)$

$\vdash (q_{aa}, abb)$

$\vdash (q_{aaa}, bb)$

$\vdash (q_{aaa}, b)$

$\vdash (q_{aaa}) \rightarrow \text{accept}$

→ 2) Step 1:

$$x = (Q, F, \Sigma, \delta, q_0)$$

Q : Total number of states = 6

F : Final state = q_3

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

δ : Transition state

q_0 : Initial state = q_s

Step 2: Logic

q_s : start state

q_0 : containing any number at 1st position

q_1 : containing 0 at 2nd position

q_2 : containing any number at 3rd position

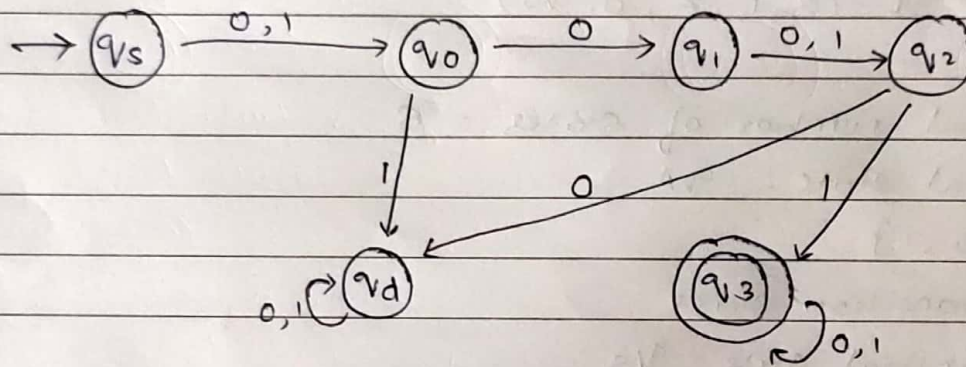
q_3 : containing 1 at 4th position

q_d : dead state

Step 3: Transition Table:

$q \backslash \Sigma$	0	1
→ q_s	q_0	q_0
q_0	q_1	q_d
q_1	q_2	q_2
q_2	q_d	q_3
* q_3	q_d	q_3
q_d	q_d	q_d

Step 4: Transition diagram



Step 5: Simulation

$(q_s, 00110)$

$\vdash (q_0, 0110)$

$\vdash (q_1, 110)$

$\vdash (q_2, 10)$

$\vdash (q_3, 0)$

$\vdash (q_3) \rightarrow \text{accept}$

8) Design FSM

→ 3) Step 1: $L = (Q, F, \Sigma, \delta, q_0)$

Q : Total number of states = 6

F : Final state = q_A

Σ : $\{0, 1\}$

δ : Transition state

q_0 : Initial state = q_s

Step 2: Logic

q_s : Start state

q_0 : State in which we have 0

q_{01} : state in which string is having 01

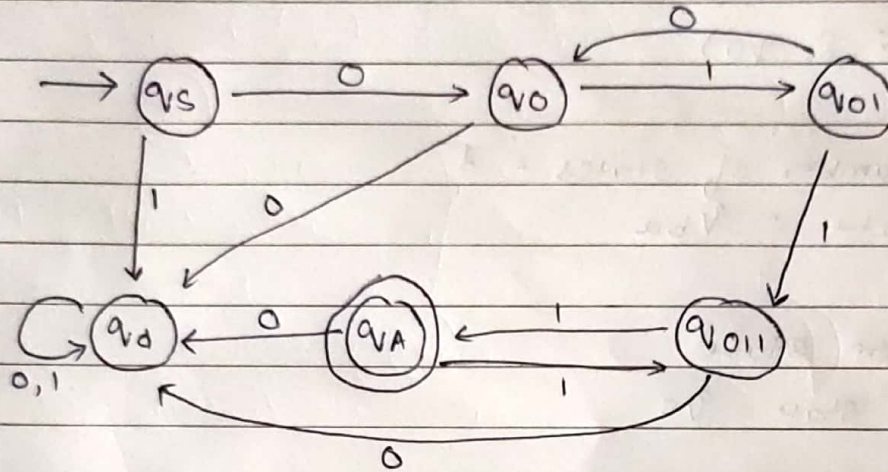
q_{011} : State containing 011 string

q_A - final state

q_d - dead state

$Q \backslash \Sigma$	0	1
$\rightarrow q_s$	q_0	q_d
q_0	q_d	q_{01}
q_{01}	q_0	q_{011}
q_{011}	q_d	q_A
* q_A	q_d	q_{011}
q_d	q_d	q_d

Step 4: Transition diagram:



Step 5: Simulation

$(q_s, 0111)$

$\vdash (q_0, 111)$

$\vdash (q_{01}, 11)$

$\vdash (q_{011}, 1)$

$\vdash (q_A) \rightarrow \text{Accept}$

→ 4) Step 1:

$L = (Q, F, \Sigma, \delta, q_0)$

Q = Total number of states = 7

F = Final state = q_{ba}

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

δ = Transition state

q_0 = Initial state = q_s

Step 2: logic

q_s = start state

q_a = String starting with a

q_{ab} = String starting with ab

q_1 = String ending with a

q_2 = String ending with b

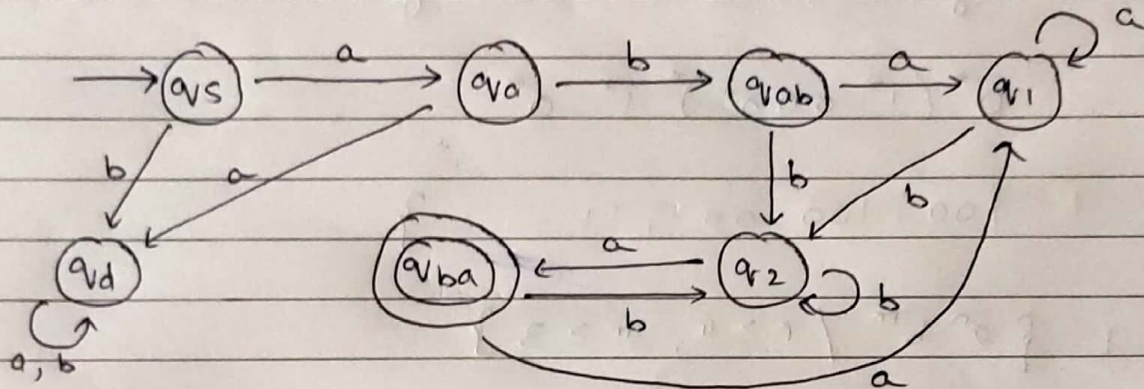
q_{ba} = String ending with ba

q_d = dead state

Step 3 : Transition table

$Q \backslash \Sigma$	a	b
$\rightarrow q_s$	q_a	q_d
q_a	q_d	q_{ab}
q_{ab}	q_1	q_2
q_1	q_1	q_2
q_2	q_{ba}	q_2
q_{ba}^*	q_1	q_2
q_d	q_d	q_d

Step 4: Transition diagram



Step 5: Simulation

eg: $(q_s, ababba)$

$\vdash (q_a, babba)$

$\vdash (q_{ab}, abba)$

$\vdash (q_1, bba)$

$\vdash (q_2, ba)$

$\vdash (q_2, a)$

$\vdash (q_{ba}) \rightarrow \text{Accept}$

→ 5) Write R.E for set of string of 0's and 1 not containing 101 as a substring.

~~ans~~ $0^*(1^*000^*)^*1^*0^*$

$$L = \{00, 100, 001, 11, \dots\}$$

→ 6) $L = \{0^n b^m / n \geq 4, m \geq 3\}$

$$aaaa \cdot a^* \cdot bbb \cdot b^*$$

$$L = \{aaaa bbb, aaaaabbbb, \dots\}$$