

Finite automata are the simplest machines to recognize patterns and it consists of $\{Q, \Sigma, q, F, \delta\}$

Q : finite set of states

Σ : set of input symbols

q : initial state

F : set of final states

δ : transition function

\therefore it is represented by $\{Q, \Sigma, q, F, \delta\}$

2) a DFA that accepts $\{a, b\}$ starting with bb
 $L = \{bb, bba, bbb, bbab, bbaa, \dots\}$

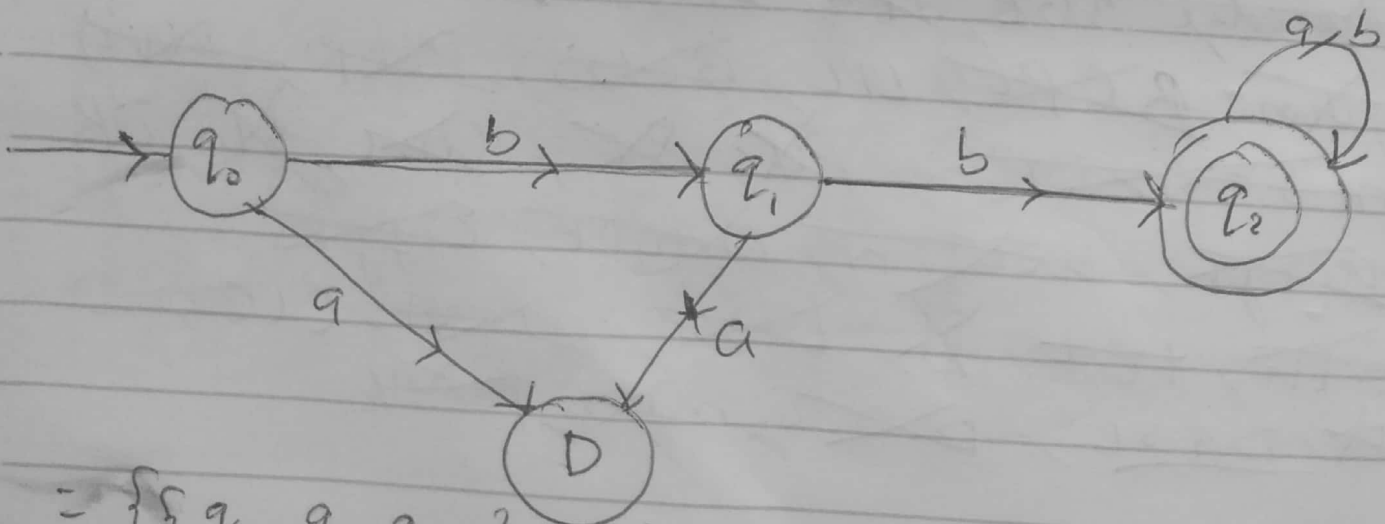
$\Sigma = \{a, b\}$ starting with bb

Regular expression = $bb(a+b)^*$

q_0 = initial state

q_2 = final state

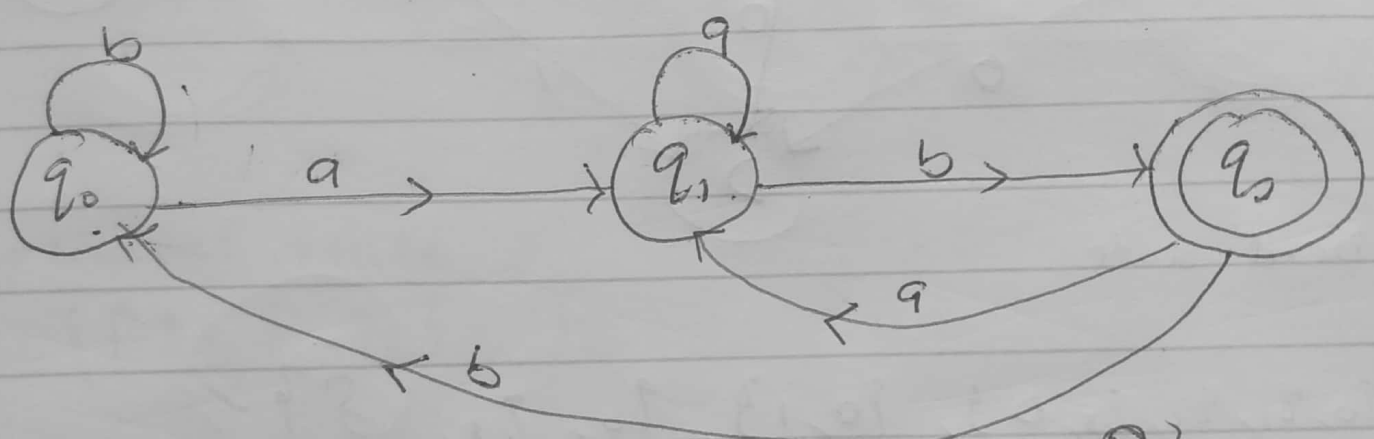
D = Dead state



$= \{\{q_0, q_1, q_2, D\}, \{a, b\}, q_0, q_2, \delta\}$

3) $\Sigma = \{a, b\}$, L ends with ab
 $L = \{ab, aab, baab, abab, \dots\}$
 Regular expression = $(a+b)^*ab$

q_0 = initial state
 q_2 = final state



$= \{\{q_0, q_1, q_2\}, \{a, b\}, q_0, q_2, \delta\}$

4) Transition table

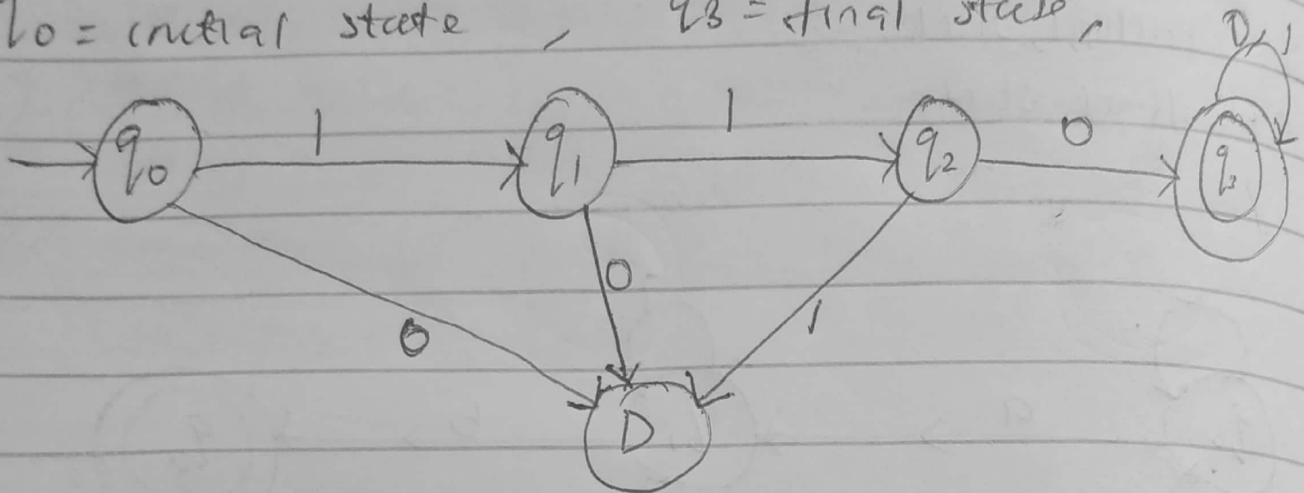
states \ input	a	b
q_0	q_1	q_0
q_1	q_1	q_2
q_2	q_1	q_0

f) $\Sigma = \{0, 1\}$, begins with 110

Regular expression: $110(0+1)^*$

$L = \{110, 1101, 1100, \dots\}$

$q_0 = \text{initial state}$, $q_3 = \text{final state}$,



D = Dead state

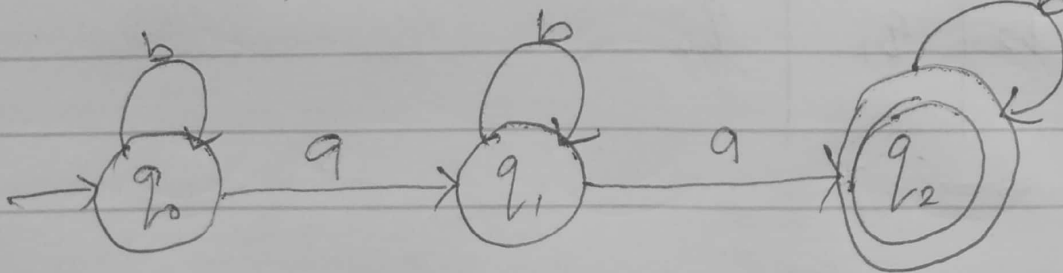
$\{ \{q_0, q_1, q_2, q_3, D\}, \{0, 1\}, q_0, q_3, \delta \}$

5(i) $\Sigma = \{a, b\}$

the string contains only 2 a's

Regular expression: $b^*ab^*ab^*$

$L = \{baa, baa, aab, baab, \dots\}$



$q_0 = \text{initial state}$

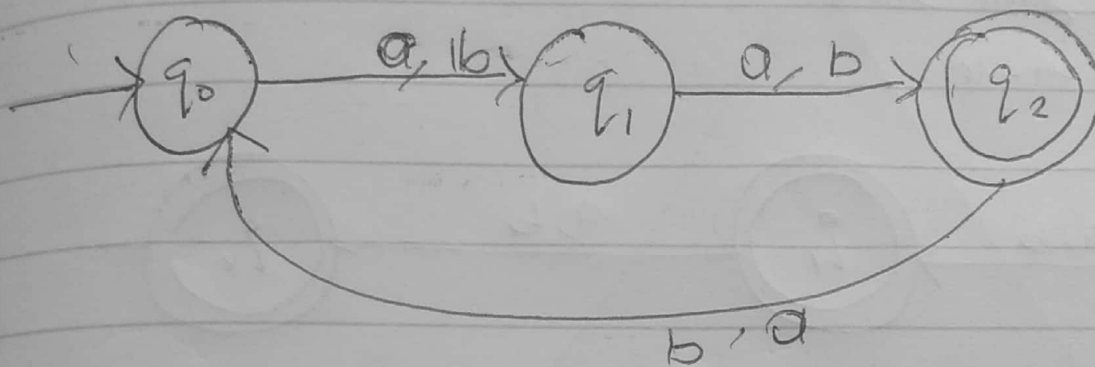
$q_2 = \text{final state}$

$\{ \{q_0, q_1, q_2\}, \{a, b\}, q_0, q_2, \delta \}$

iii) $w \in \{a, b\}^*$; $|w| \equiv 2 \pmod 3$

possible lengths = $\{2, 5, 8, 11, \dots\}$

$L = \{aa, ab, bb, ba, aabab, abaab, ababab, \dots\}$



$q_0 = \text{initial state}$; $q_2 = \text{final state}$

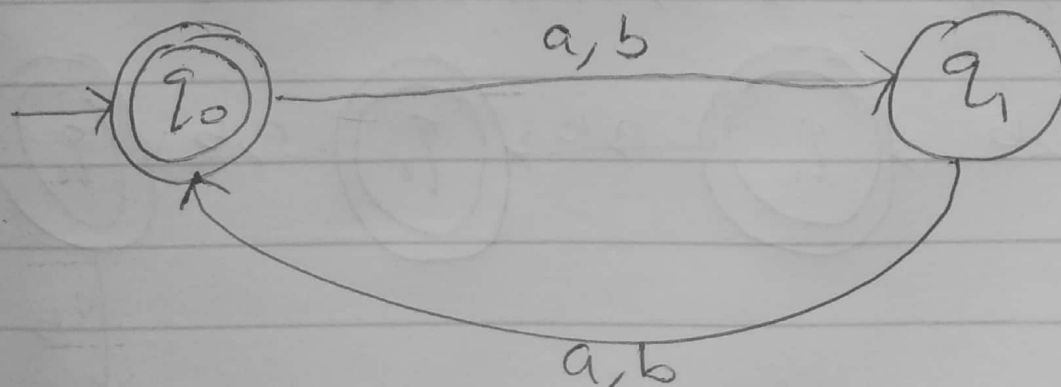
$\{\{q_0, q_1, q_2\}, \{a, b\}, q_0, q_2, \delta\}$

ii) $w \in \{a, b\}^* \mid |w| \equiv 0 \pmod 2$

$\therefore \text{length} = \{0, 2, 4, 6, 8, 10, \dots\}$

$q_0 = \text{final state}$

$q_0 = \text{initial state}$



$\{\{q_0, q_1\}, \{a, b\}, q_0, q_0, \delta\}$

(v) Length of string \leq atmost 3

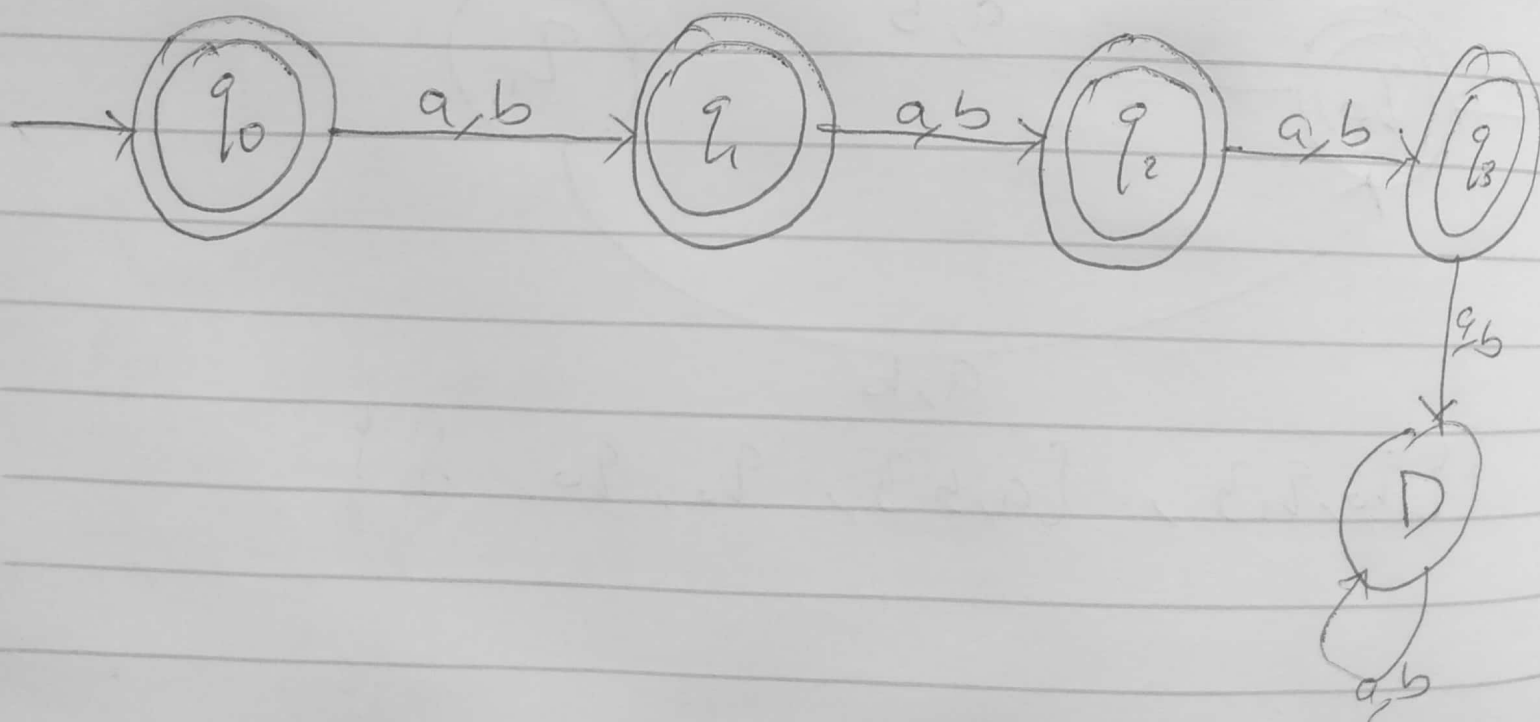
Lengths: 0, 1, 2, 3

q_0 = initial state

q_0, q_1, q_2, q_3 = final state

D = Dead state

$= \{ \{q_0, q_1, q_2, q_3, D\}, \{a, b\}, q_0, \{q_0, q_1, q_2, q_3\}, \delta \}$



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