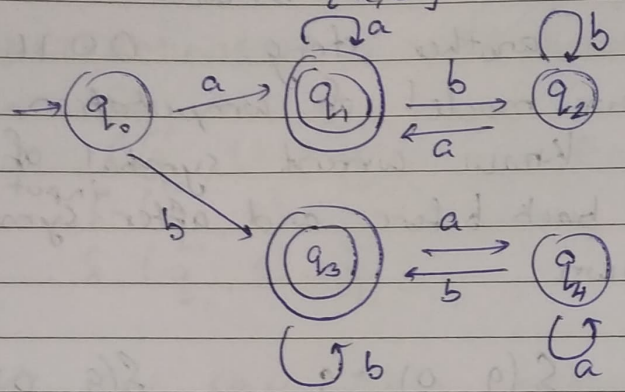
DFA Examples

eg. $L(M) = \{ w \mid w$ is a string that starts and ends with the same symbol$\}$
ε excluded.

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

acceptable strings
a ... a
b ... b

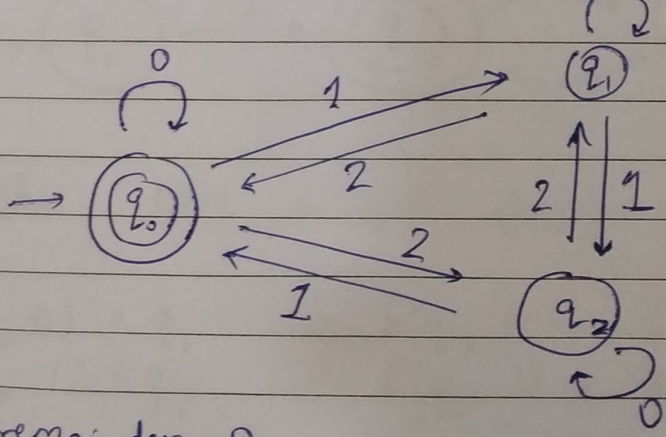


q_1: if I saw 'a', then I will stay on q_1

Prove formally this DFA accepts $L(M)$, give reasoning for states, define $\{Q, \Sigma, \delta, q_0, F\}$

eg $\Sigma = \{0, 1, 2\}$

L = { w | w sum of numbers in w modulo 3 is 0 }



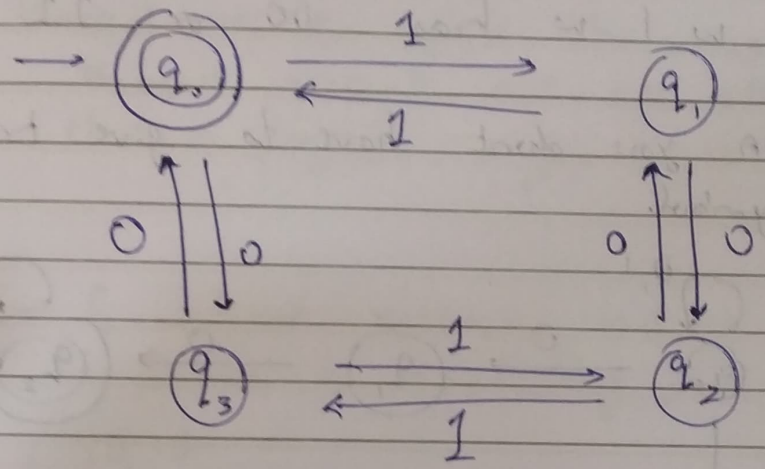
try making/considering diff cases to construct all transitions. states.
We can confirm by checking $|\delta| = |Q| \times |\Sigma|$

q_0 → remainder 0
q_1 → " 1
q_2 → " 2

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

$L = \{ w \mid w$ has even number of 0s or 1s $\}$

0011 ✓ 01010 ✗ 0101 ✓



q_0 → even 1's, even 0's
q_1 → odd 1's, even 0's
q_2 → odd 1's, odd 0's
q_3 → even 1's, odd 0's

$\delta(q_1, 0) = q_3$
$\delta(q_1, 1) = q_1$

} Check for all, and if they correspond to one transition (one to one) then it can be proved deterministic.

Different type of Machiene

Nondeterministic finite Automata (NFA)

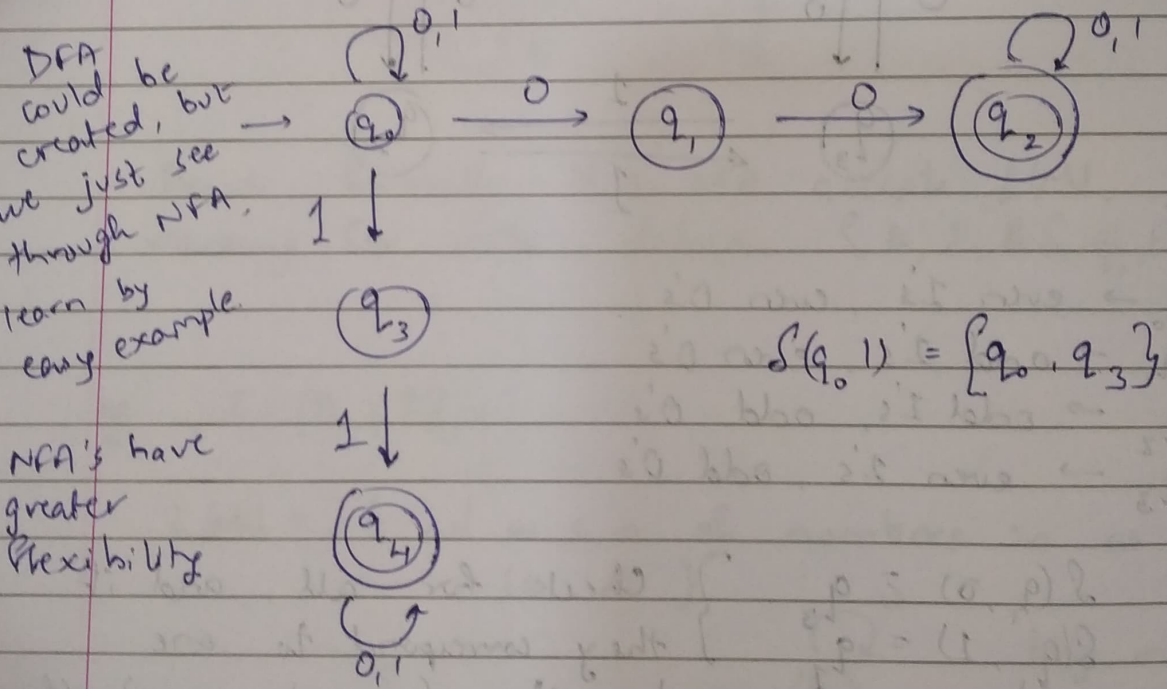
$\delta: Q \times \{\Sigma \cup \{\varepsilon\}\} \rightarrow P(Q)$ (power set of Q)

(ε → empty string)

$\delta(q, \alpha) = \{q_1, q_2, q_3\}$

$L = \{ w \mid w$ has 00 or 11 as a string$\}$

In NFA you dont have to give transistion for every symbol.

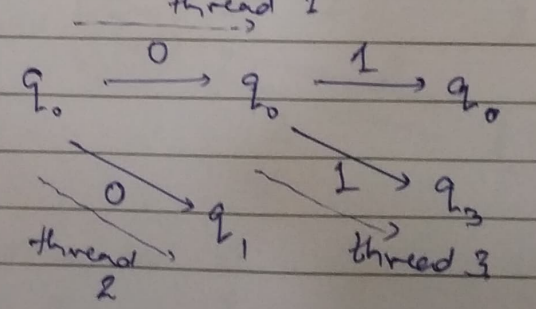


DFA could be created, but we just see through NFA. learn by easy example

NFA's have greater flexibility

$\delta(q_0, 1) = \{q_0, q_3\}$

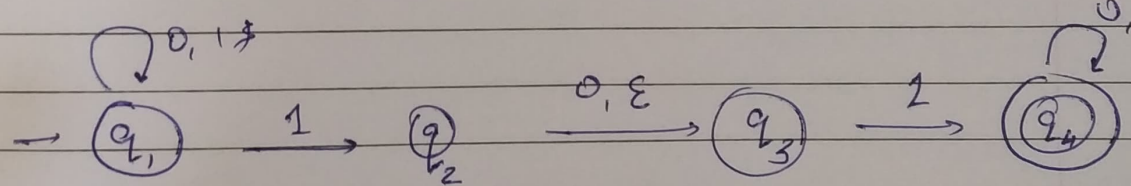
Different threads are created in the process.



there are multiple threads.
Each thread is going to have an execution control
- its individual input string
- state machine maintains its state.

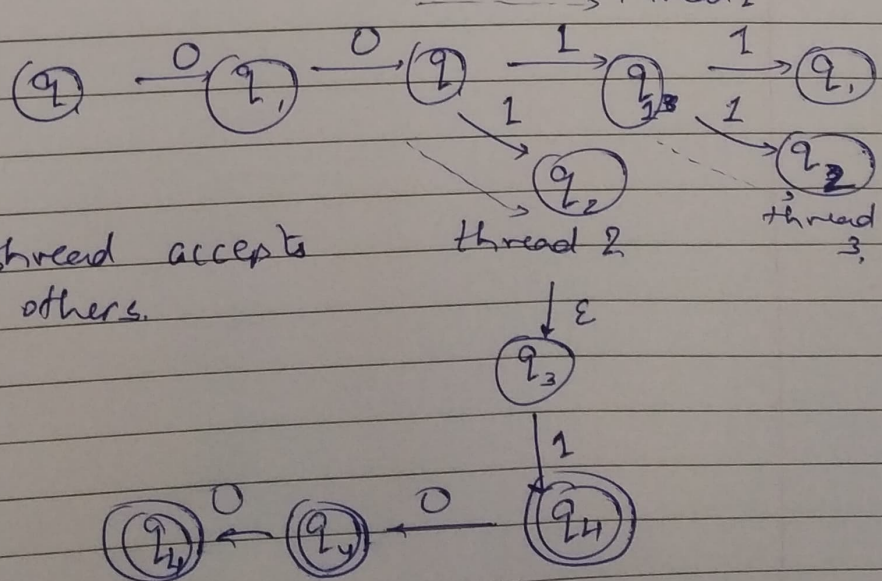
any thread accepts, accept the input
every thread rejects, reject the input
if a thread accepts, kill all other threads.
if a thread rejects, ignore it.

eg $L = \{ w \mid w$ contains either 101 or 11 as a substring $\}$



$$\delta(q_1, 1) = \{ q_1, q_2 \}$$

Ex analysing execution context and threads.
00 11 00



Even if one thread accepts input, kill all others.