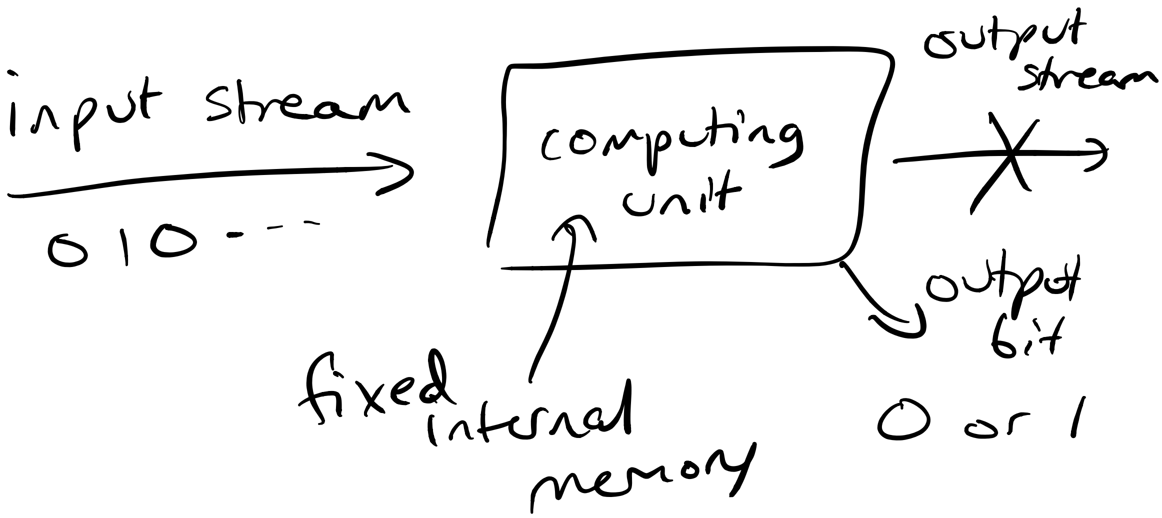
Theory of Computing



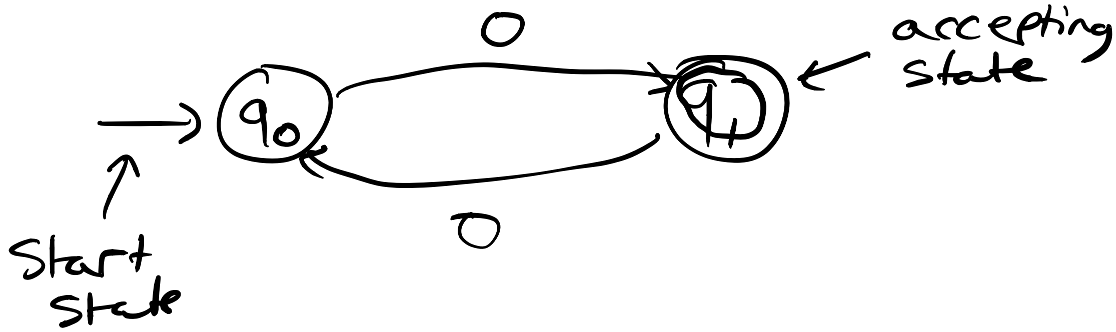
Computing unit:

<u>State</u> of this machine is its memory configuration

Fixed internal mem = possible states of the machine

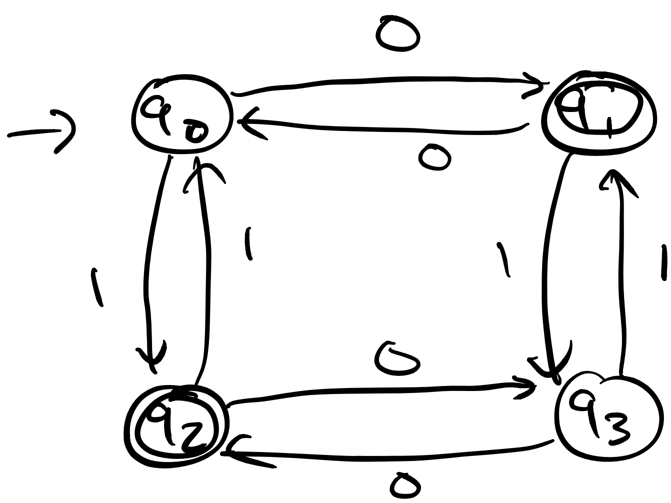
we need some designation as to the states of whether they accept/not accept the input.

Also a designation to 1 state as to whether it is the "start" state.



Input		0	0	0
State	q_0	q_1	q_0	q_1

accept 000



ε − do not accept
0 − accept
1 − "
10 − does not accept

A Deterministic Finite Automaton is a ____-tuple $(Q, \Sigma_1, \delta, q_0, F)$

where

(1st: $\Sigma_1 = \{0\}$
2nd: $\Sigma_1 = \{0, 1\}$)

Q = finite set of "states"

Σ_1 = finite alphabet (set)

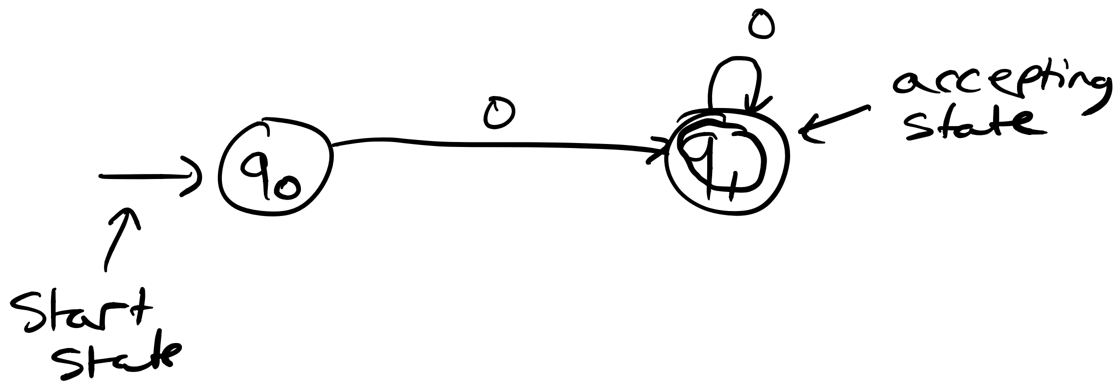
δ is the "transition function"

$q_0 \in Q$ is the "start state"

$F \subseteq Q$ is the set of "final states"

$$\delta : Q \times \Sigma_1 \to Q$$

is a <u>total</u> function



Input	0	0	0
State q_0	q_1	q_0	q_1

accept 000

Formal def'n:

$Q = \{q_0, q_1\}$

$\Sigma = \{0\}$

$q_0 = q_0$

$F = \{q_1\}$

Transition function

$\delta(q_0, 0) = q_1$

$\delta(q_1, 0) = q_0$

Transition table:

symbols

states	0
q_0	q_1
q_1	q_0

Let Σ be an alphabet.

Call Σ^* is the set of all strings over Σ.

- If $\Sigma = \{0, 1\}$, Σ^* is the set of all binary strings.
  01
  110101
- If $\Sigma = \emptyset$, $\Sigma^* = \{\varepsilon\}$ "epsilon"
  λ

A <u>computation</u> of a DFA $M = (Q, \Sigma, \delta, q_0, F)$ and a string $w \in \Sigma^*$ where $|w| = n$ and $w = w_1 w_2 \cdots w_n$ and each $w_i \in \Sigma$ is a sequence of $n+1$ states

$$(r_0, r_1, r_2, \ldots, r_n)$$

where:

(1) $r_0 = q_0$

(2) $r_i = \delta(r_{i-1}, w_i)$ for all $1 \le i \le n$

$r_1 = \delta(r_0, w_1)$

$r_2 = \delta(r_1, w_2)$

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$r_i = \delta(r_{i-1}, w_i)$

An <u>accepting computation</u> of M on w is a computation $(r_0, \ldots, r_n)$ and $r_n \in F$.

The language accepted/recognized by a DFA $M = (Q, \Sigma, \delta, q_0, F)$, $L(M)$, is

$\{ w \in \Sigma_1^* :$ M has an accepting computation on $w \}$.

\# of computations always is 1.
but # of accepting computations can be either 1 or 0.

Language (in general) is a set of strings.

A language L is called <u>regular</u> if it is accepted by some DFA.

- $\Sigma_1^* \setminus \{\varepsilon\}$ is regular
- Σ_1^*  loop on every thing
- $\emptyset$  ''
- $\{0\}$ see above