dfa

Thursday, September 5, 2024 11:58 AM

$M_{dfa} = (Q, \Sigma, \delta, q_i, F)$

- Q = finite set of internal state(s)
- Σ = finite set of symbol = input alphabet
- δ = finite set of transition fnc(s)
  $\delta: Q \times \Sigma \to Q$
  ex. $Q = \{q_0, q_1, q_2\}$ $\Sigma = \{a, b\}$
  $Q \times \Sigma = \{(q_0,a), (q_0,b), (q_1,a), (q_1,b), (q_2,a), (q_2,b)\}$
  $\delta: (q_0, b) \to q_1$ $[\delta(q_0,b) = q_1]$

aside:
$S_1 = \{a, b, c\}$
$S_2 = \{1, 2\}$
$S_1 \times S_2 = \{(a,1), (a,2), (b,1), (b,2), (c,1), (c,2)\}$

- q_0 = initial state $\in Q$.
  F = *final state(s) $\subset Q$.
  finite set of*

ex $M_1 = (\{q_0, q_1, q_2\}, \{a,b\}, \delta, q_0, \{q_2\})$

δ: 1. $(q_0, a) = q_0$ 2. $(q_0, b) = q_1$
3. $(q_1, a) = q_2$ 4. $(q_1, b) = q_2$
5. $(q_2, a) = q_0$ 6. $(q_2, b) = q_2$

$s_1 = a$ ... q_0 $s_1 \notin L_1$
$s_2 = bb$ ... q_1 ... q_2 $s_2 \in L_1$ bb
$s_3 = ab$ ... q_0 ... q_1 $s_3 \notin L$
$s_4 = abb$ ... q_0 ... q_1 ... q_2 $s_4 \in L$ abb
$s_5 = abab$ $q_0\ q_1\ q_2\ q_2$ $s_5 \in L$ abab
$s_6 = baab$ $q_1\ q_2\ q_0\ q_1$ $s_6 \notin L$
$s_7 = \lambda$

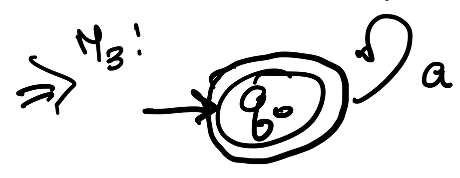
ex $M_1 = (\{q_0, q_1, q_2\}, \{a,b\}, \delta, q_0, \{q_1\})$
$L_1 = \{a^n : n \geq 1\}$ $\Sigma = \{a,b\}$ $Q = \{q_0, q_1, q_2\}$ $F = \{q_1\}$
δ: $(q_0, a) = q_1$ $(q_0, b) = q_2$
$(q_1, a) = q_1$ $(q_1, b) = q_2$
$(q_2, a) = q_2$ $(q_2, b) = q_2$ $L(M_1) = L_1$

$M_2 = (\{q_0, q_1\}, \{a\}, \delta, q_0, \{q_1\})$
$L_2 = \{a^n : n \geq 1\}$ $\Sigma = \{a\}$ $Q = \{q_0, q_1\}$ $F = \{q_1\}$
δ: $(q_0, a) = q_1$
$(q_1, a) = q_1$ $L(M_2) = L_2$

ex $L_3 = \{a^n : n \geq 0\}$
$M_3 = (\{q_0\}, \{a\}, \delta, q_0, \{q_0\})$
$(q_0, a) = q_0$

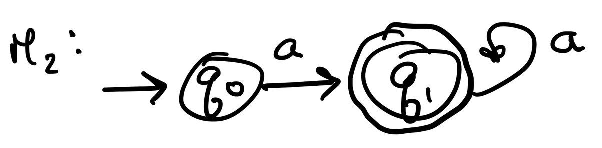
State diagrams:

ex $L_3 = \{a^n : n \geq 0\}$

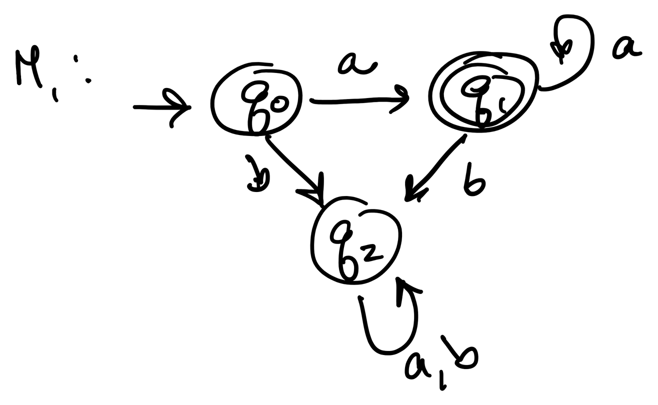
M_3:


$\Sigma = \{a\}$

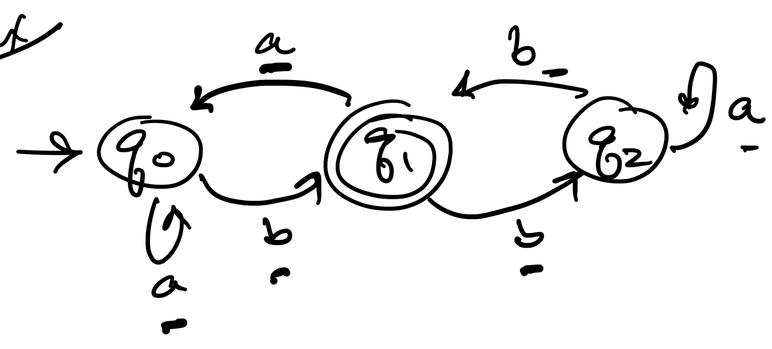
ex $L_2 = \{a^n : n \geq 1\}$ $\Sigma = \{a\}$

M_2:


ex $L_1 = \{a^n : n \geq 1\}$ $\Sigma = \{a, b\}$

M_1:


$M_1 = M_2$ iff $L(M_1) = L(M_2)$

ex


δ^* is the extended transition function.
[the second argument is a string (not a symbol)
$\delta^*: Q \times \Sigma^* \to Q$

ex. if $\delta(q_0, a) = q_1$ and $\delta(q_1, b) = q_2$
$\Rightarrow \delta^*(q_0, ab) = q_2$

give couple examples of dfa, nfa.