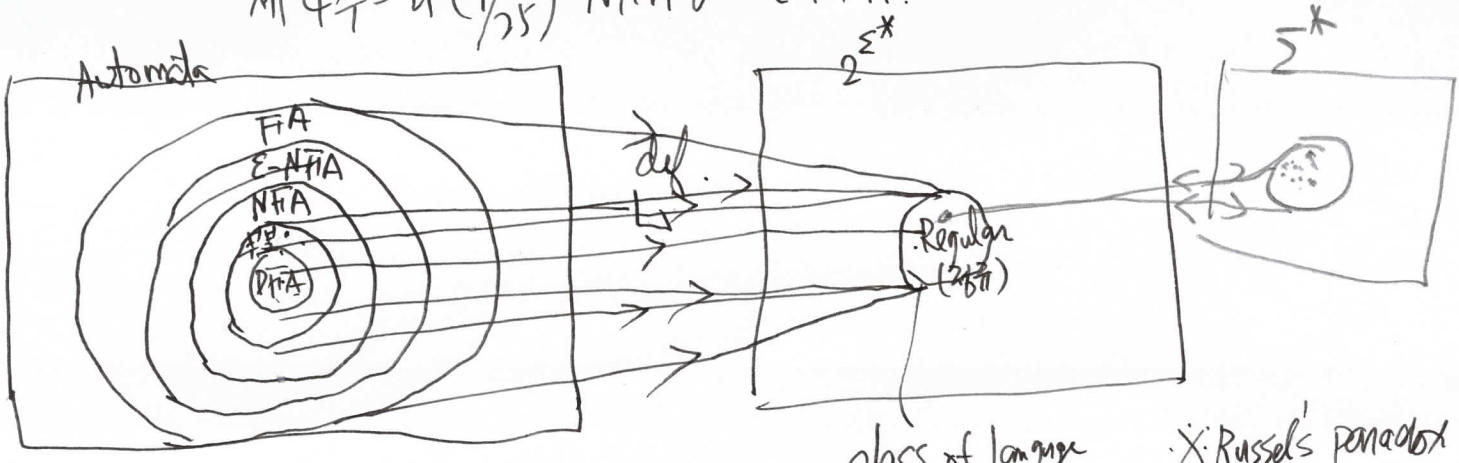
제 4주 - 4차(9/25) NFA & ε-NFA.



class of language ※ Russel's paradox.

NFiA Nondeterministic Finite state Automata

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

$\delta : Q_{NFA} \times \Sigma \to 2^{Q_{NFA}} \quad (\phi \in 2^Q)$

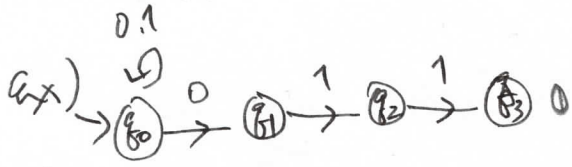
$D = (Q, \Sigma, \delta, q_0, F)$ $\exists. L(N) = L(D)$

where $\delta : Q \times \Sigma \to Q$.

Pf 2.1

- DFiA $\delta_{DFA} : Q \times \Sigma \to Q$
- 부분 $\delta_{부분} : Q \times \Sigma \to Q \cup \{\phi\}$
- NFiA $\delta_{NFA} : Q \times \Sigma \to 2^Q$
- ε-NFiA $\delta_{\varepsilon\text{-NFA}} : Q \times (\Sigma \cup \{\varepsilon\}) \to 2^Q$
- FiA $\delta_{FiA} : Q \times \Sigma^* \to 2^Q$

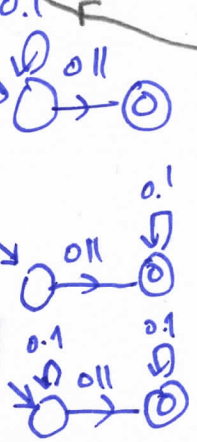
NFiA Pf 2.

ex) 

① 011로 끝나는 문자열 $\in \{0,1\}^*$ 011의 suffix 이다.

② 011로 시작하는 … " prefix "

③ 011을 포함하는 " substring ".

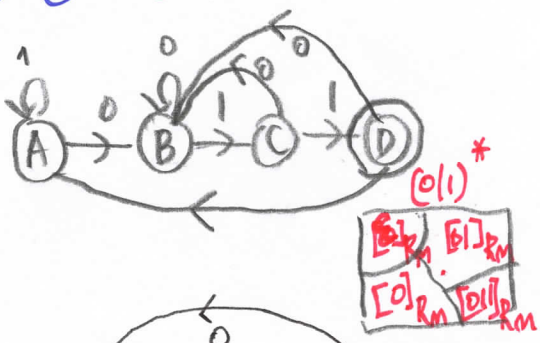


① $(0|1)^*011$. regular expression (정규식 : chay3)

② $011(0|1)^*$

③ $(0|1)^*011(0|1)^*$

δ_{NFA}	0	1
→ q_0	$\{q_0, q_1\}$	$\{q_0\}$
q_1	$\{\}$	$\{q_2\}$
q_2	$\{\}$	$\{q_3\}$
◎ q_3	$\{\}$	$\{\}$



subset construction

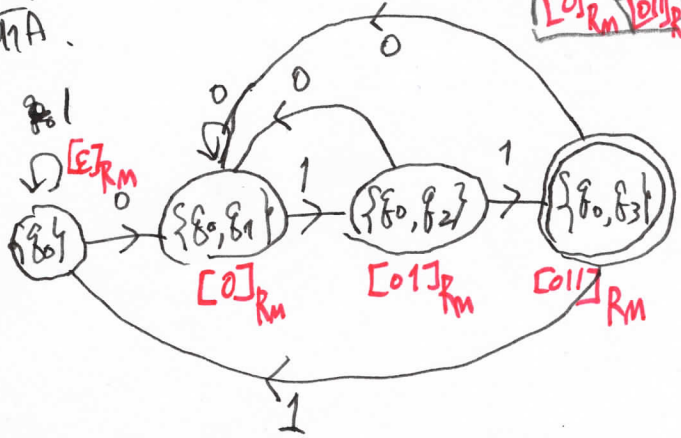
$\delta_{DFA} : 2^{Q_{NFA}} \times \Sigma \to 2^{Q_{NFA}}$

$\because 2^{|Q_{NFA}|}$ state

new. DFA.

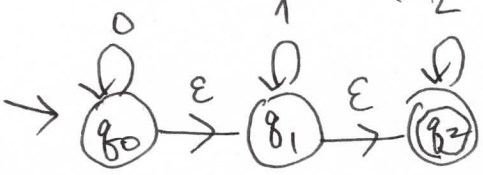
2^Q	0	1
→ $\{q_0\}$	$\{q_0, q_1\}$	$\{q_0\}$
$\{q_0, q_1\}$	$\{q_0, q_1\}$	$\{q_0, q_2\}$
$\{q_0, q_2\}$	$\{q_0, q_1\}$	$\{q_0, q_3\}$
◎ $\{q_0, q_3\}$	$\{q_0, q_1\}$	$\{q_0\}$

	0	1
A	B	A
B	B	C
C	B	D
◎ D	B	A



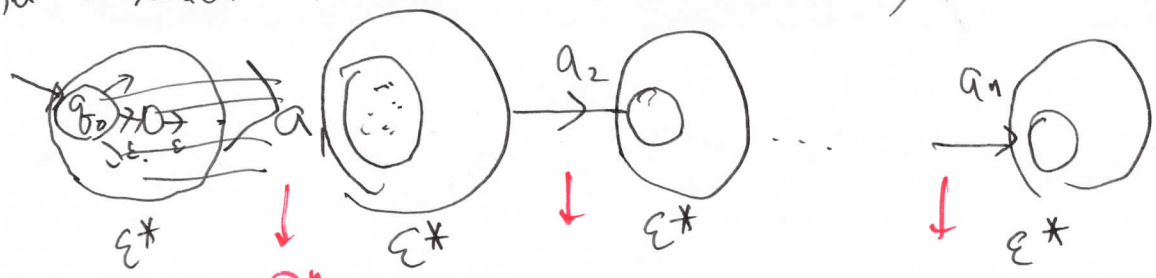
ε-NFA : ε-move를 허용하는 NFA

$\delta_{\varepsilon\text{-NFA}}: Q \times (\Sigma \cup \{\varepsilon\}) \to 2^Q$



$0^*1^*2^*$

subset construction + closure of ε-moves (ε^*)



δ^n - moves $a \in \Sigma$ - n번

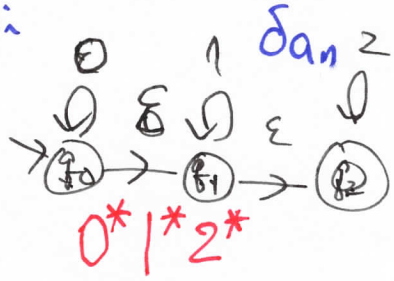
ε^* - moves — (n+1)번

$\varepsilon^*(\delta(\ldots\varepsilon^*(\delta^*(\ldots\varepsilon^*(\delta(\varepsilon^*(\{q_0\}), a_1))\cdots, a_i))\ldots, a_n))$

$\varepsilon^* \circ (\delta_{a_1} \circ \varepsilon^*) \circ (\delta_{a_2} \circ \varepsilon^*) \circ \cdots \circ (\delta_{a_i} \circ \varepsilon^*) \circ \cdots \circ (\delta_{a_n} \circ \varepsilon^*)$

δ_{a_1} δ_{a_2} δ_{a_i} δ_{a_n}

2^Q \ Σ	0	1	2
→ $\varepsilon^*(\{q_0\})$	$\varepsilon^*(\{q_0\})$	$\varepsilon^*(\{q_1\})$	$\varepsilon^*(\{q_2\})$
◎ $=\{q_0, q_1, q_2\}$	= 〃	$=\{q_1, q_2\}$	$=\{q_2\}$
$\{q_1, q_2\}$	$\varepsilon^*(\phi)$	$\varepsilon^*(\{q_1\})$	$\varepsilon^*(\{q_2\})$
◎	$=\phi$	$=\{q_1, q_2\}$	$=\{q_2\}$
$\{q_2\}$	$\varepsilon^*(\phi)$	$\varepsilon^*(\phi)$	$\varepsilon^*(\{q_2\})$
◎	$=\phi$	$=\phi$	$=\{q_2\}$



$0^*1^*2^*$