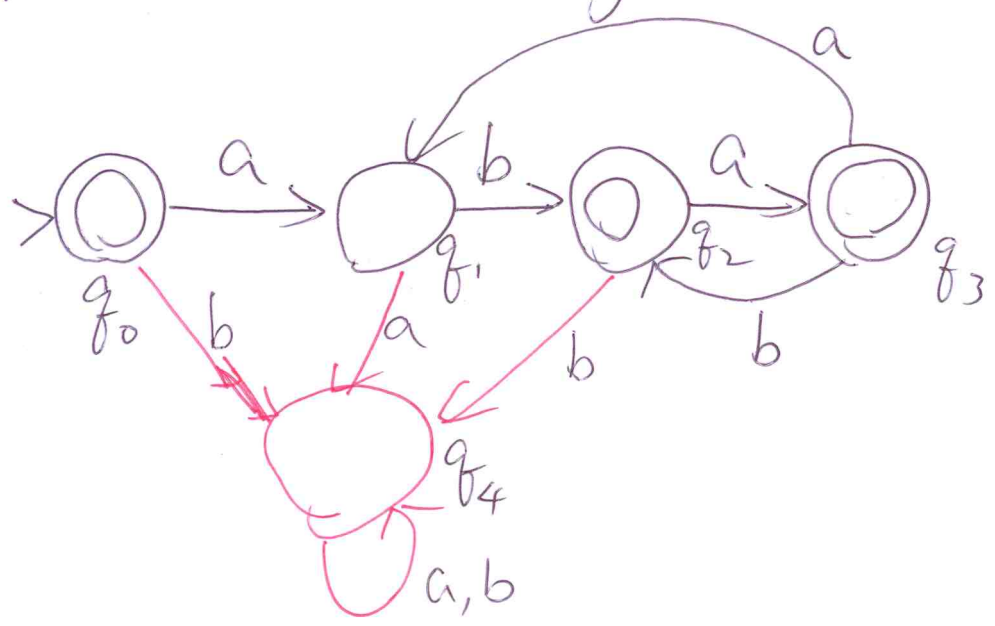


NFA

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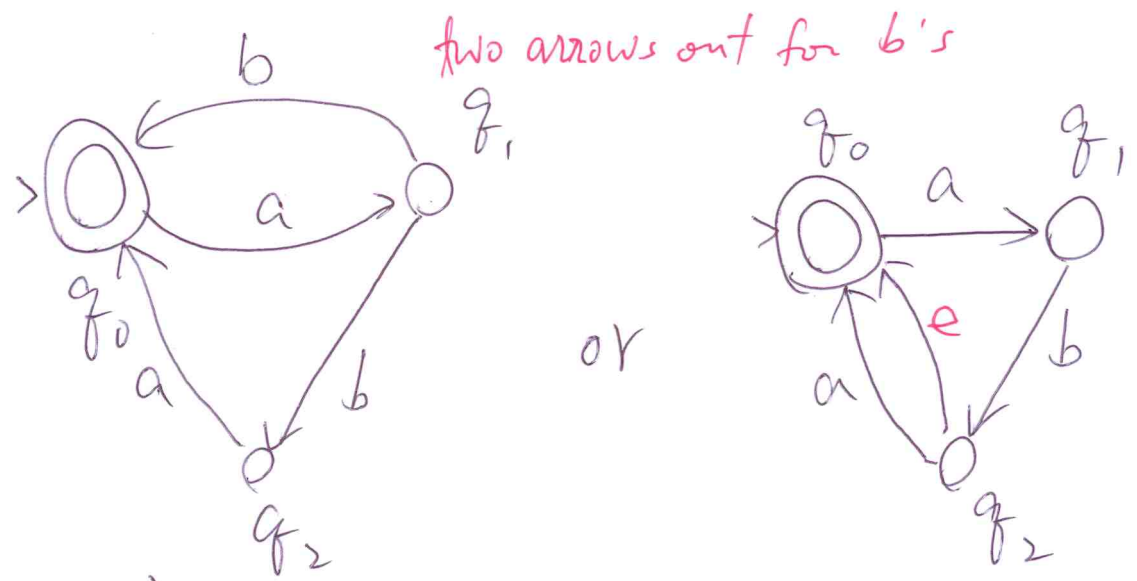
$$\alpha = (ab \cup aba)^*$$

M_α : A DFA for recognize α



M_α : An NFA for recognizing α

↳ Nondeterministic



two arrows out for b's

$K = \{q_0, q_1, q_2\}$
 $\Sigma = \{a, b\}$
 $s = q_0$
 $F = \{q_0\}$

Δ :

q	σ	p
q_0	a	q_1
q_1	b	q_0
q_1	a	q_2
q_2	b	q_0

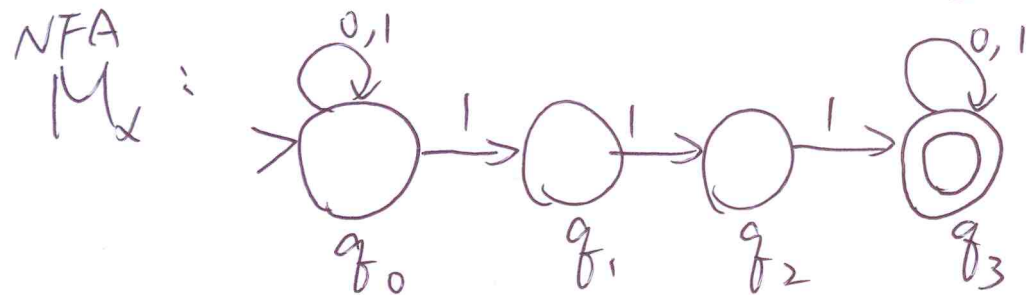
with an "e" move.

Δ :

q	σ	p
q_0	a	q_1
q_1	b	q_2
q_2	a	q_0
q_2	e	q_0

$$\alpha = (0011)^* 111 (0011)^*$$

$$\mathcal{L}(\alpha) = \{w \in \{0,1\}^* : w \text{ has the substring } 111\}$$



$$(q_0, 01101111) \vdash_{M_\alpha} (q_0, 1101111)$$

$$\vdash_{M_\alpha} (q_0, 101111)$$

$$\vdash_{M_\alpha} (q_0, 01111)$$

$$\vdash_{M_\alpha} (q_0, 1111)$$

$$\vdash_{M_\alpha} (q_1, 111)$$

$$\vdash_{M_\alpha} (q_0, 111)$$

$$\vdash_{M_\alpha} (q_2, 11)$$

$$\vdash_{M_\alpha} (q_1, 11)$$

$$\vdash_{M_\alpha} (q_3, 1)$$

$$\vdash_{M_\alpha} (q_2, 1)$$

$$\vdash_{M_\alpha} (q_3, \epsilon)$$

$$\vdash_{M_\alpha} (q_3, \epsilon)$$

accepted

accepted.

A string is accepted by a nondeterministic finite automaton if and only if there is at least one sequence of moves leading to a final state.

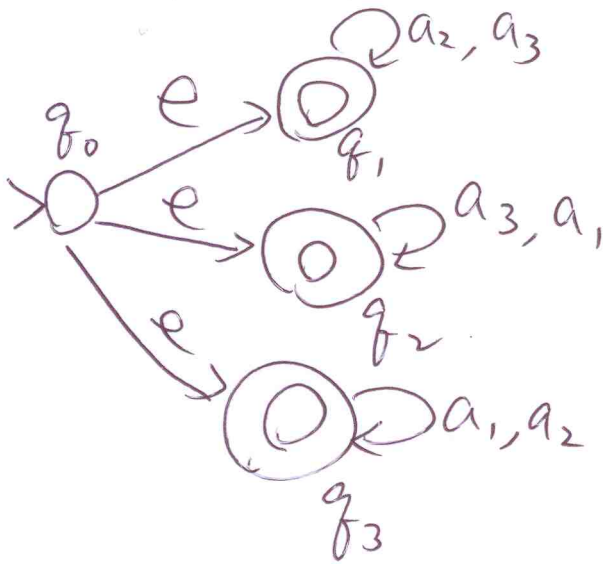
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$L = \{w \in \{a_1, a_2, a_3\}^* : \text{there is a symbol } a_i \in \{a_1, a_2, a_3\} \text{ not appearing in } w\}$

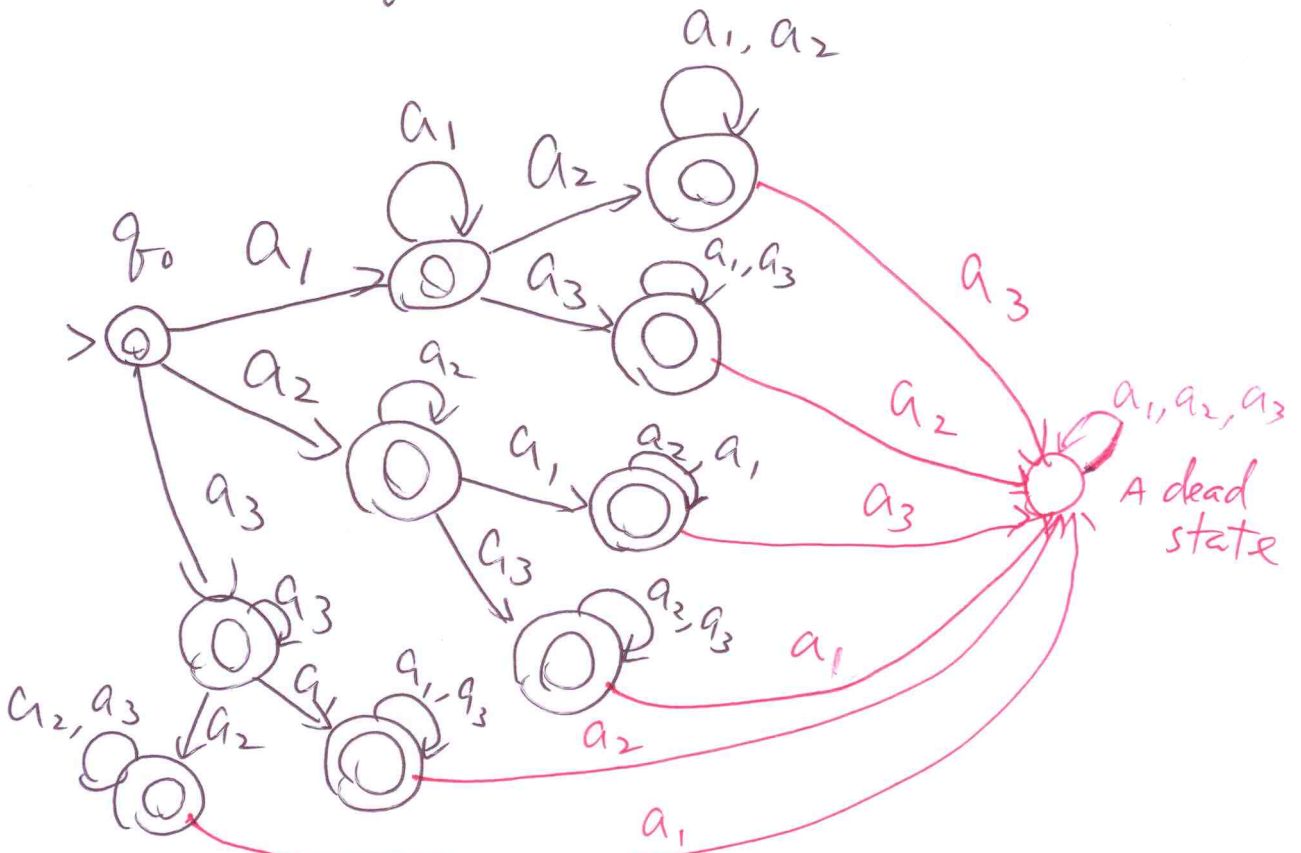
$\epsilon, a_1, a_2, a_3, a_1 a_2, a_1 a_3, a_2 a_1, a_2 a_3, \dots$

$a_1 a_2 a_3, a_1 a_1 a_3 a_2, \dots$

NFA



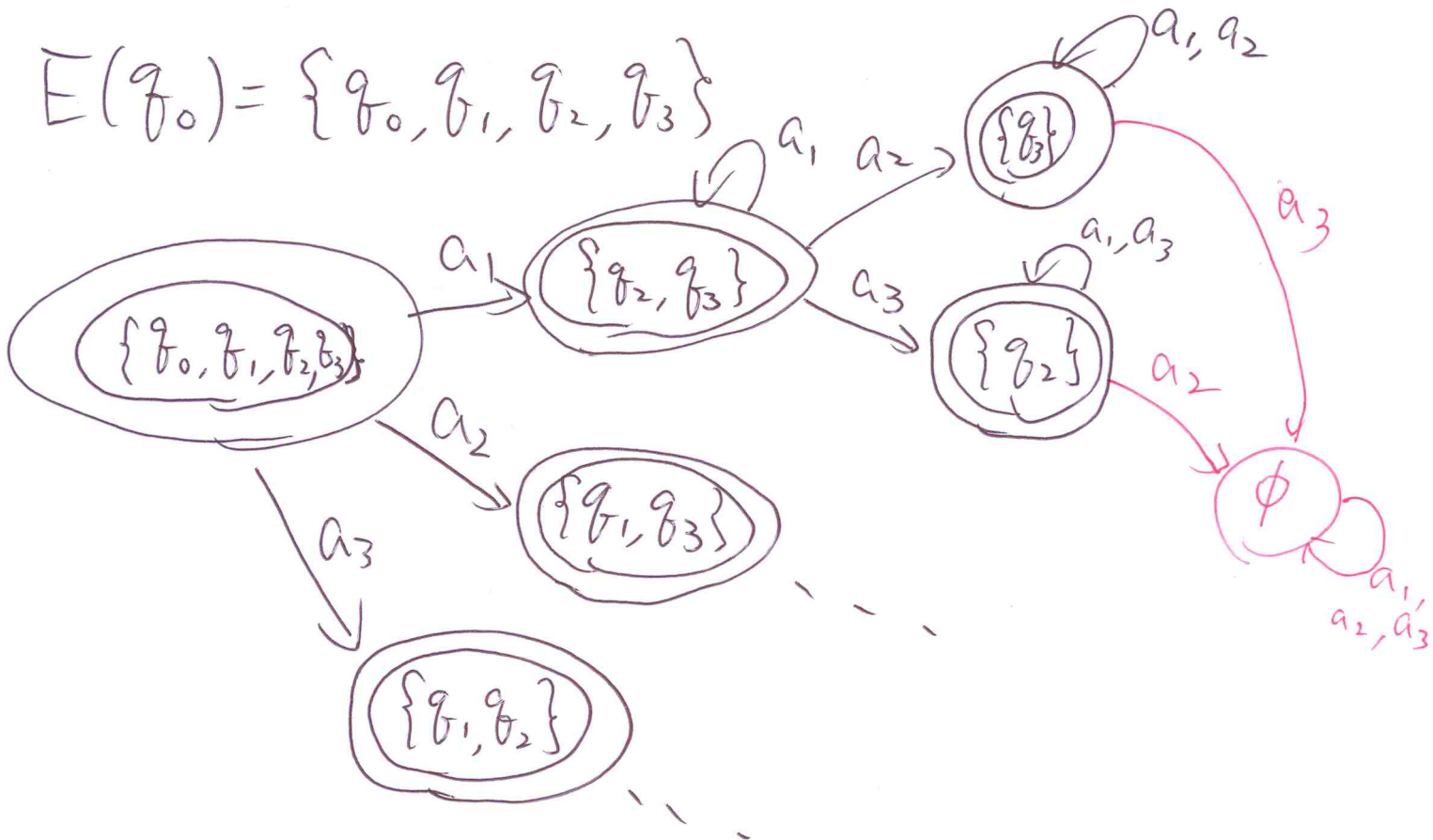
DFA



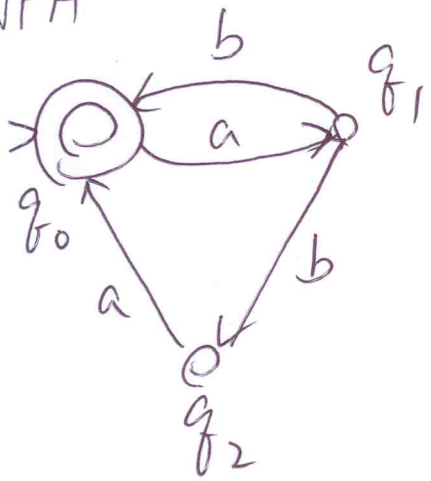
NFA \rightarrow DFA

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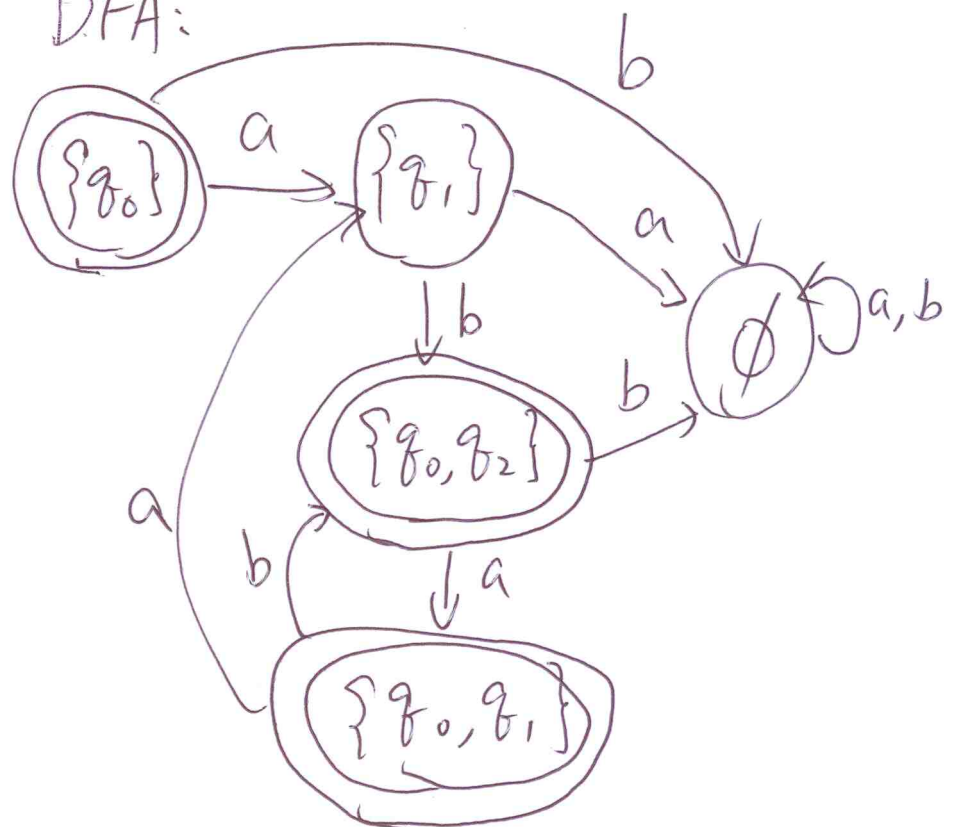
$$E(q_0) = \{q_0, q_1, q_2, q_3\}$$



NFA: $(ab \cup aba)^*$

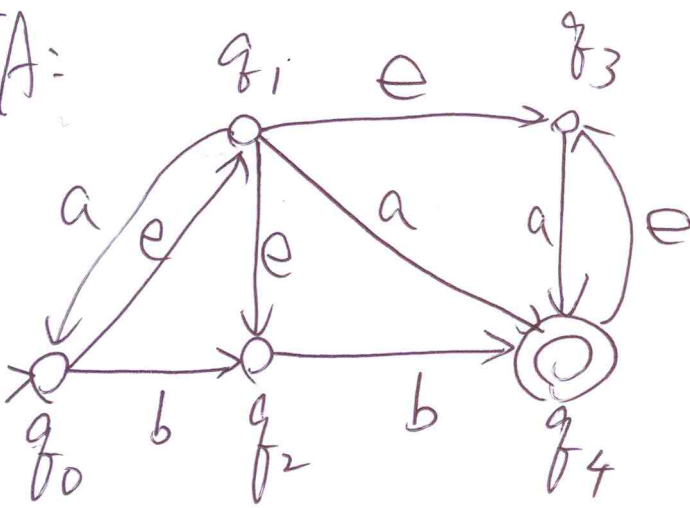


DFA:



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NFA:



$$E(q_0) = \{q_0, q_1, q_2, q_3\}$$

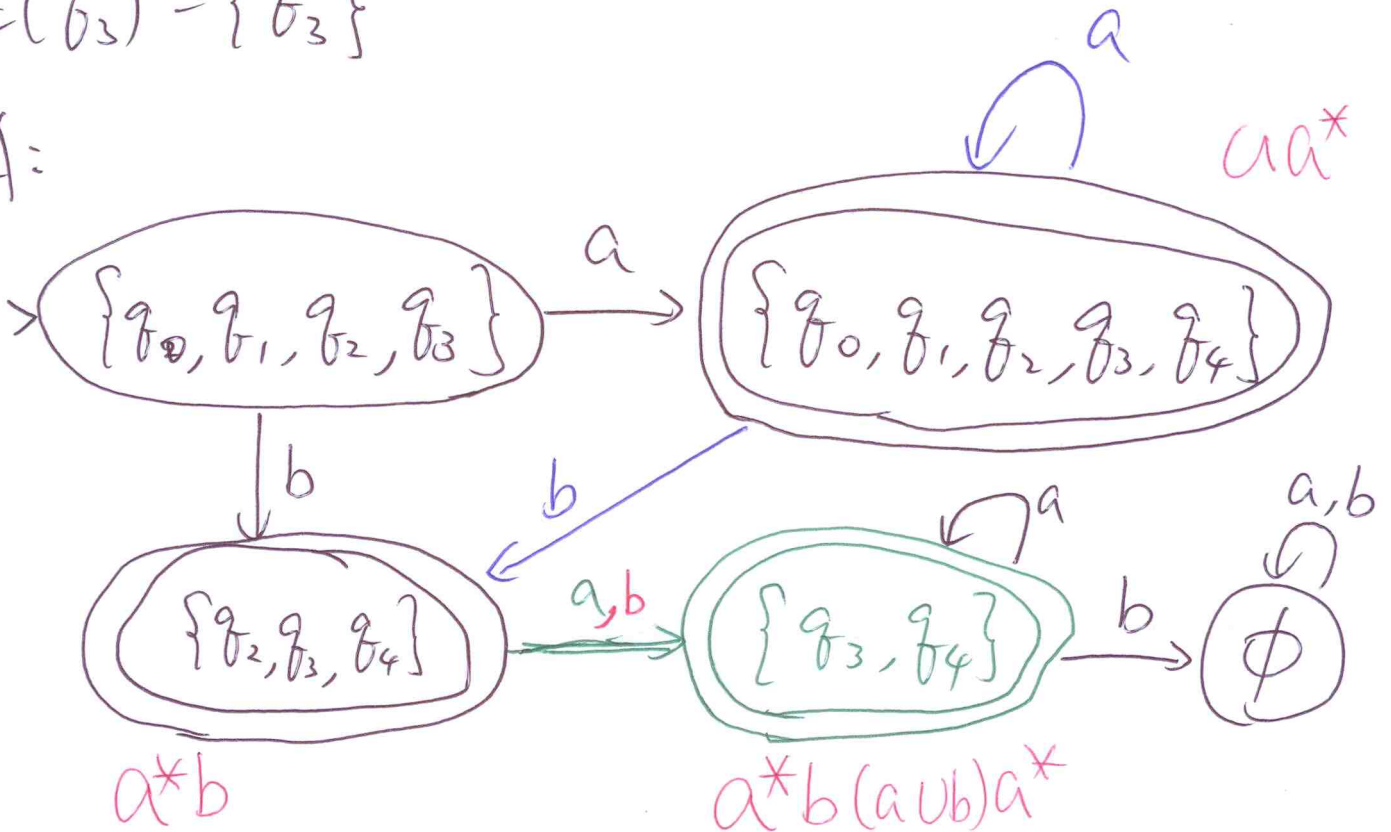
$$E(q_1) = \{q_1, q_2, q_3\}$$

$$E(q_4) = \{q_4, q_3\}$$

$$E(q_2) = \{q_2\}$$

$$E(q_3) = \{q_3\}$$

DFA:



$$aa^* \cup a^*b \cup a^*b(a \cup b)a^*$$