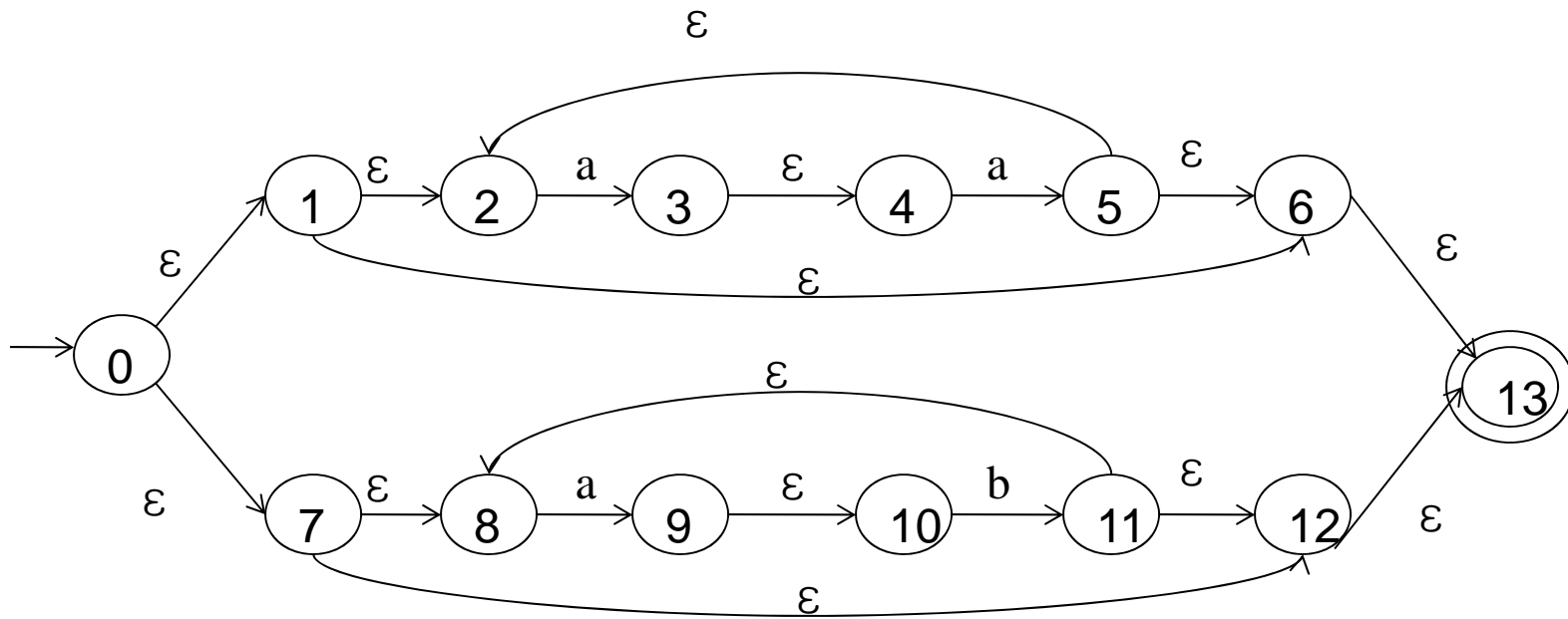


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## Practice Problem

- For the regular expression  $(aa)^* \mid (ab)^*$ , construct an NFA using the method discussed in class, convert that NFA and then minimize the resulting DFA.

RE  $(aa)^* \mid (ab)^*$  to NFA



# Convert NFA for $(aa)^* \mid (ab)^*$ to a DFA

$$q_0 = \varepsilon - \text{closure}(\{s_0\}) = \{s_0, s_1, s_7, s_2, s_6, s_8, s_{12}, s_{13}\} = \{s_0, s_1, s_2, s_6, s_7, s_8, s_{12}, s_{13}\} // \text{start state, final state}$$

$$T[q_0, a] = \varepsilon - \text{closure}(\{s_3, s_9\}) = \{s_3, s_9, s_4, s_{10}\} = \{s_3, s_4, s_9, s_{10}\} = q_1$$

$$T[q_0, b] = \varepsilon - \text{closure}(\{\}) = \{\} = q_e$$

$$T[q_1, a] = \varepsilon - \text{closure}(\{s_5\}) = \{s_5, s_2, s_6, s_{13}\} = \{s_2, s_5, s_6, s_{13}\} = q_2 // \text{final state}$$

$$T[q_1, b] = \varepsilon - \text{closure}(\{s_{11}\}) = \{s_{11}, s_8, s_{12}, s_{13}\} = \{s_8, s_{11}, s_{12}, s_{13}\} = q_3 // \text{final state}$$

$$T[q_2, a] = \varepsilon - \text{closure}(\{s_3\}) = \{s_3, s_4\} = q_4$$

$$T[q_2, b] = \varepsilon - \text{closure}(\{\}) = \{\} = q_e$$

$$T[q_3, a] = \varepsilon - \text{closure}(\{s_9\}) = \{s_9, s_{10}\} = q_5$$

$$T[q_3, b] = \varepsilon - \text{closure}(\{\}) = \{\} = q_e$$

$$T[q_4, a] = \varepsilon - \text{closure}(\{s_5\}) = q_2$$

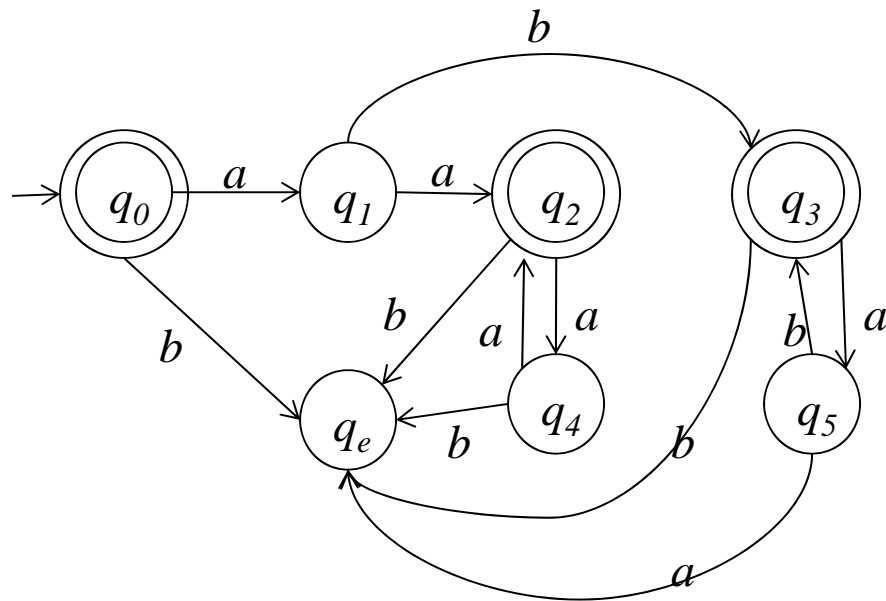
$$T[q_4, b] = \varepsilon - \text{closure}(\{\}) = \{\} = q_e$$

$$T[q_5, a] = \varepsilon - \text{closure}(\{\}) = \{\} = q_e$$

$$T[q_5, b] = \varepsilon - \text{closure}(\{s_{11}\}) = q_3$$

# DFA for $(aa)^* \mid (ab)^*$

	<i>a</i>	<i>b</i>
$q_0$	$q_1$	$q_e$
$q_1$	$q_2$	$q_3$
$q_2$	$q_4$	$q_e$
$q_3$	$q_5$	$q_e$
$q_4$	$q_2$	$q_e$
$q_5$	$q_e$	$q_3$



# Minimize the DFA

- Initially,  $p_0 = \{q_0, q_2, q_3\}$  // final states  
 $p_1 = \{q_1, q_4, q_5\}$

$p_0$	$a$
$q_0$	$p_1$
$q_2$	$p_1$
$q_3$	$p_1$

No change

$p_0$	$b$
$q_0$	$p_e$
$q_2$	$p_e$
$q_3$	$p_e$

No change

$p_1$	$a$
$q_1$	$p_0$
$q_4$	$p_0$
$q_5$	$p_e$

partition  $p_1$   
into  $p_1 = \{q_5\}$  and  $p_2 = \{q_1, q_4\}$

## Minimize the DFA (cont.)



$$p_0 = \{q_0, q_2, q_3\}$$

$$p_1 = \{q_5\}$$

$$p_2 = \{q_1, q_4\}$$

$p_0$	$a$
$q_0$	$p_2$
$q_2$	$p_2$
$q_3$	$p_1$

partition  $p_0$   
into  $p_0 = \{q_3\}$  and  $p_3 = \{q_0, q_2\}$

# Minimize the DFA (cont.)



$$p_0 = \{q_3\}$$

$$p_1 = \{q_5\}$$

$$p_2 = \{q_1, q_4\}$$

$$p_3 = \{q_0, q_2\}$$

$p_2$	$a$
$q_1$	$p_3$
$q_4$	$p_3$

No change

$p_2$	$b$
$q_1$	$p_0$
$q_4$	$p_e$

partition  $p_2$   
into  $p_2 = \{q_1\}$  and  $p_4 = \{q_4\}$

## Minimize the DFA (cont.)



$$p_0 = \{q_3\}$$

$$p_1 = \{q_5\}$$

$$p_2 = \{q_1\}$$

$$p_3 = \{q_0, q_2\}$$

$$p_4 = \{q_4\}$$

$p_3$	$a$
$q_0$	$p_2$
$q_2$	$p_4$

partition  $p_3$   
into  $p_3 = \{q_0\}$  and  $p_5 = \{q_2\}$



# Minimize the DFA (cont.)



$$p_0 = \{q_3\}$$

$$p_1 = \{q_5\}$$

$$p_2 = \{q_1\}$$

$$p_3 = \{q_0\}$$

$$p_4 = \{q_4\}$$

$$p_5 = \{q_2\}$$

