

Homework Assignment 2

- Let $\Sigma = \{\mathbf{a}, \mathbf{b}\}$. Give NFAs that recognize the following languages. The answer must be a state diagram.
 - $L_1 = \{w \mid w \text{ starts with } \mathbf{ab} \text{ and ends with } \mathbf{ba}\}$ using five states.
 - $L_2 = \{w \mid w \text{ contains neither } \mathbf{aa} \text{ nor } \mathbf{bb}\}$ using three states.
 - $L_3 = \{\mathbf{ab}\}$ using three states.
- Convert the NFA $N_1 = (\{q_1, q_2, q_3, q_4\}, \{\mathbf{a}, \mathbf{b}\}, \delta, q_1, \{q_2, q_4\})$ into a DFA, where δ is defined below. Show only the reachable states. The answer must be a state diagram.

$$\begin{aligned}\delta(q_1, \epsilon) &= \{q_2\} \\ \delta(q_1, \mathbf{a}) &= \{q_2\} \\ \delta(q_1, \mathbf{b}) &= \{q_3\} \\ \delta(q_3, \mathbf{a}) &= \{q_2, q_3\} \\ \delta(q_3, \mathbf{b}) &= \{q_4\} \\ \delta(q, c) &= \emptyset \quad \text{otherwise}\end{aligned}$$

- Let $N_2 = (\{q_1, q_2, q_3\}, \{\mathbf{a}, \mathbf{b}\}, \delta, q_1, \{q_3\})$ where

$$\begin{aligned}\delta(q_1, \mathbf{a}) &= \{q_1, q_2\} \\ \delta(q_1, \mathbf{b}) &= \{q_1\} \\ \delta(q_2, \mathbf{a}) &= \{q_3\} \\ \delta(q, c) &= \emptyset \quad \text{otherwise}\end{aligned}$$

The answers must be given as state diagrams.

- Using the method from class, give an NFA that recognizes $N_2 \cdot N_1$
- Using the method from class, give an NFA that recognizes $N_1 \cup N_2$
- Using the method from class, give an NFA that recognizes N_2^*