

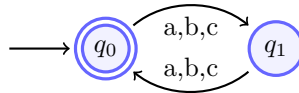
Automata & Formal Languages

Homework 1 – Deterministic Finite Automata

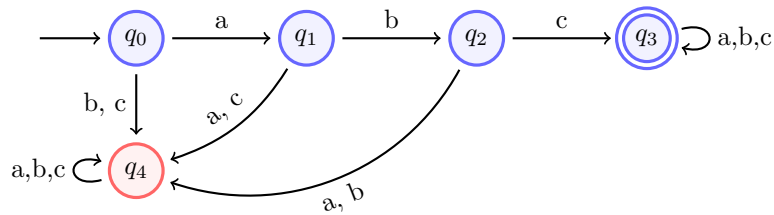
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March 5, 2020

1. $\mathcal{L} = \{w \in \{a, b, c\}^* : (\exists n \in \mathbb{N} : |W| = 2n)\}$



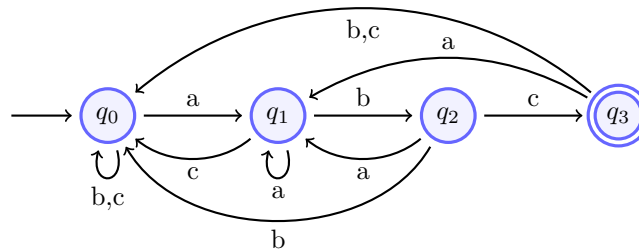
2. $\mathcal{L} = \{w \in \{a, b, c\}^* : abc \sqsubseteq w\}$



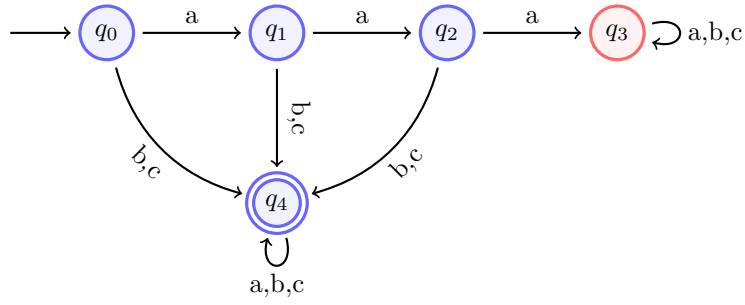
3. $\mathcal{L} = \{w \in \{a, b, c\}^* : abc \sqsupseteq w\}$

For this language, the word “aaaabc” belongs in the language, but “aaa” does not. For the string “aaaabc” the DFA accepts it as follows.

$q_0 a \rightarrow q_1 a \rightarrow q_1 a \rightarrow q_1 a \rightarrow q_1 b \rightarrow q_2 c \rightarrow q_3$



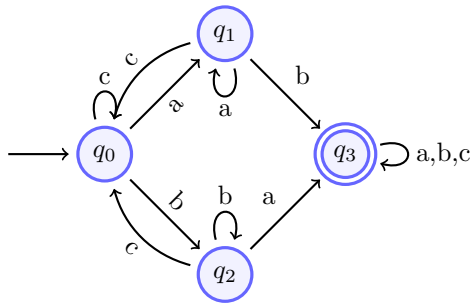
4. $\mathcal{L} = \{w \in \{a, b, c\}^* : aaa \not\sqsubseteq w\}$



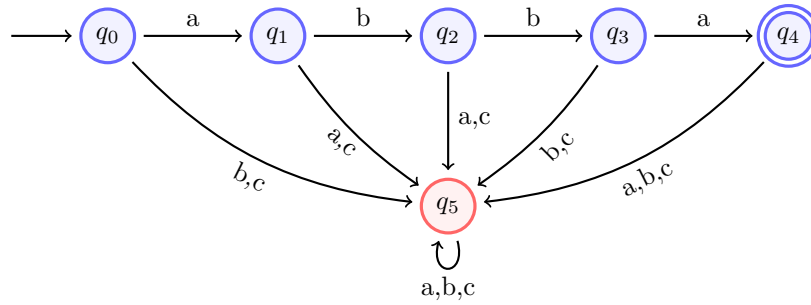
The transition table for this automata is as follows.

| | a | b | c |
|-------------------|-------|-------|-------|
| $\rightarrow q_0$ | q_1 | q_4 | q_4 |
| q_1 | q_2 | q_4 | q_4 |
| q_2 | q_3 | q_4 | q_4 |
| q_3 | q_3 | q_3 | q_3 |
| q_4 | q_4 | q_4 | q_4 |

5. $\mathcal{L} = \{w \in \{a, b, c\}^* : (\exists u, v \in \{a, b, c\}^* : w = u \circ ab \circ v \vee w = u \circ ba \circ v)\}$



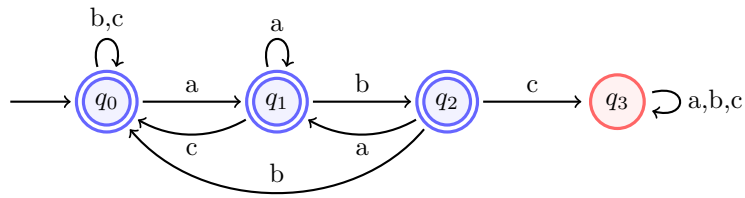
6. $\mathcal{L} = \{\text{abba}\}$ where $\Sigma = \{a, b, c\}$



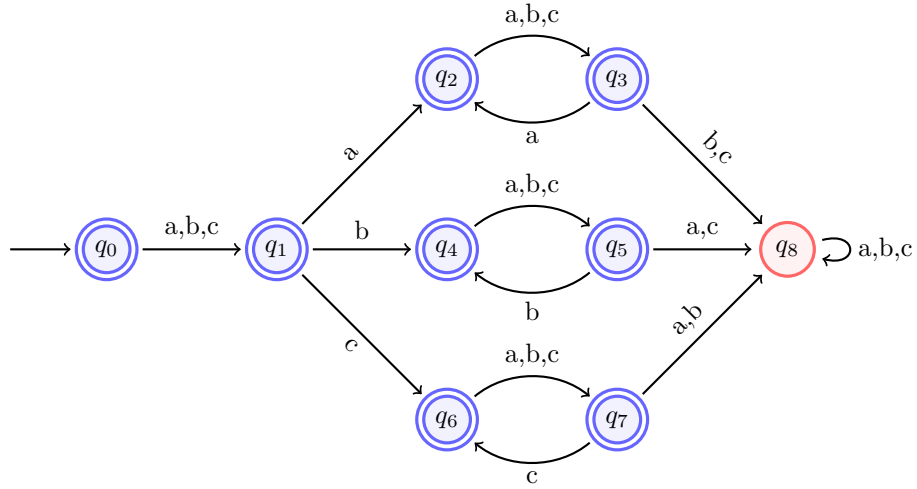
7. $\mathcal{L} = \{w \in \{a, b, c\}^* : \forall u, v \in \{a, b, c\}^*, w \neq u \circ abc \circ v\}$

For this language, the string “cbabcba” does not belong in the language, but “cbacba” does. The DFA processes the accepted word as follows.

$q_0c \rightarrow q_0b \rightarrow q_0a \rightarrow q_1c \rightarrow q_0b \rightarrow q_0a \rightarrow q_1$



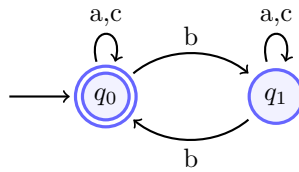
8. $\mathcal{L} = \{w \in \{a, b, c\}^* : w \text{ has the same symbol in all even positions}\}$



The transition table for this automata is as follows.

| | a | b | c |
|-------------------|-------|-------|-------|
| $\rightarrow q_0$ | q_1 | q_1 | q_1 |
| q_1 | q_2 | q_4 | q_6 |
| q_2 | q_3 | q_3 | q_3 |
| q_3 | q_2 | q_8 | q_8 |
| q_4 | q_5 | q_5 | q_5 |
| q_5 | q_8 | q_4 | q_8 |
| q_6 | q_7 | q_7 | q_7 |
| q_7 | q_8 | q_8 | q_6 |
| q_8 | q_8 | q_8 | q_8 |

9. $\mathcal{L} = \{w \in \{a, b, c\}^* : (\exists n \in \mathbb{N} : \#_b(w) = 2n)\}$



10. $\mathcal{L} = \{abaa, abbaa\}$ where $\Sigma = \{a, b\}$

