

FLA (Fall 2026) – Assignment 1

Name: _____ Dept: _____

Grade: _____ ID: _____

Due: Sep. 22, 2026

Problem 1

Provide DFAs and REs of the following languages. In all parts, the alphabet $\Sigma = \{0, 1\}$ and $|v|_\omega$ denotes the number of occurrences of substring v in string ω . You are encouraged to simplify your DFAs and REs whenever possible.

- a. $\{\omega \mid \text{every run of consecutive 1's in } \omega \text{ has even length}\}$
- b. $\{\omega \mid |\omega| \geq 2 \text{ and the second symbol from the right of } \omega \text{ is } 1\}$
- c. $\{\omega \mid |00|_\omega = 1\}$
- d. $\{\omega \mid |01|_\omega \equiv 0 \pmod{3}\}$

Solution.

Problem 2

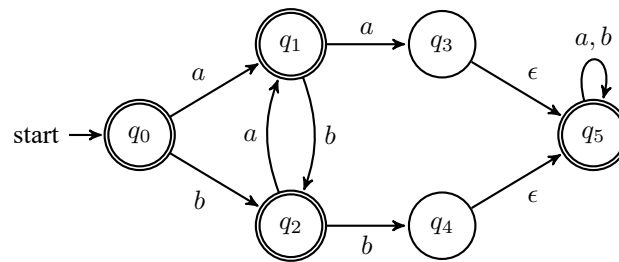
Let $R = (\mathbf{ab} + \mathbf{c})^*(\mathbf{a} + \mathbf{bc})$

- a. Convert R to an ϵ -NFA. (You may omit some unnecessary ϵ -transitions.)
- b. Convert the ϵ -NFA to a DFA by subset construction.

Solution.

Problem 3

Consider the following ϵ -NFA N over the alphabet $\Sigma = \{a, b\}$.



Let

$$R = (a + b)(a + b)^*.$$

Answer the following questions.

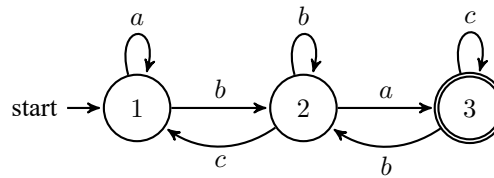
- Determine whether the strings $ababa$, $aabba$, and $bbab$ are accepted by N . For each accepted string, give one accepting path.
- Determine whether $L(N)$ and $L(R)$ are the same language. Justify your answer. If they are different, characterize exactly how they differ and state the relationship between the two languages.

Solution.

Problem 4

Given the DFA shown below with alphabet $\Sigma = \{a, b, c\}$, please give the regular expressions for the following R_{ij}^k , and **try to simplify the expressions as much as possible**.

- a. $R_{11}^0, R_{12}^0, R_{13}^0$.
- b. $R_{21}^1, R_{22}^1, R_{23}^1$.
- c. $R_{31}^2, R_{32}^2, R_{33}^2$.
- d. Give a regular expression for the language accepted by this DFA.



Solution.