

FLA (Fall 2024) – Assignment 1

Name: _____ Dept: _____

Grade: _____ ID: _____

Due: Oct. 13, 2024

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 .

- a. $\{\omega \mid \text{Every even position of } \omega \text{ is } 1 \text{ and } |\omega| \text{ is odd.}\}$
- b. $\{\omega \mid |110|_\omega \geq 1\}$
- c. $\{\omega \mid |01|_\omega = |10|_\omega\}$
- d. $\{\omega \mid |0|_\omega \bmod 3 \equiv 0 \wedge |1|_\omega \bmod 2 \equiv 0\}$ **(DFA only)**

Solution.

Problem 2

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

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

Solution.

Problem 3

Consider the following ϵ -NFA:

	ϵ	a	b	c
$\rightarrow p$	$\{q, r\}$	\emptyset	$\{q\}$	$\{r\}$
q	\emptyset	$\{p\}$	$\{r\}$	$\{p, q\}$
$*r$	\emptyset	\emptyset	\emptyset	\emptyset

- Give all the strings of length three or less accepted by the automaton.
- Convert the automaton to an NFA.

Solution.

Problem 4

Give a DFA as figure below, please give the regular expression for the following R_{ij}^k , and **try to simplify the expressions as much as possible**.

- $R_{11}^0, R_{12}^0, R_{13}^0$.
- $R_{21}^1, R_{22}^1, R_{23}^1$.
- $R_{31}^2, R_{32}^2, R_{33}^2$.
- The RE for this DFA.

Hint:

- $(\epsilon + R)^* = R^*$
- $R + SR = (\epsilon + S)R$
- $\epsilon + RR^* = R^*$
- $(R + S)^* = (R^*S)^*R^*$

Solution.

