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. $\{\omega \mid \text{Every even position of } \omega \text{ is 1 and } |\omega| \text{ is odd.}\}$

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
$\to p$	$\{q, r\}$	$\emptyset$	$\{q\}$	$\{r\}$
q	$\emptyset$	$\{p\}$	$\{r\}$	$\{p, q\}$
$*r$	$\emptyset$	$\emptyset$	$\emptyset$	$\emptyset$

a. Give all the strings of length three or less accepted by the automaton.

b. 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**.

a. $R_{11}^0, R_{12}^0, R_{13}^0$.

b. $R_{21}^1, R_{22}^1, R_{23}^1$.

c. $R_{31}^1, R_{32}^2, R_{33}^2$.

d. The RE for this DFA.

Hint:

1. $(\epsilon + R)^* = R^*$

2. $R + SR = (\epsilon + S)R$

3. $\epsilon + RR^* = R^*$

4. $(R + S)^* = (R^*S)^*R^*$

Solution.