JUST A TEST

Q1. Regular Expression

(a) All strings over {a, b} that start and end with the same symbol
a(a|b)*a | b(a|b)*b | a | b

(b) All binary strings representing powers of 2
(1—0)*0

(c) All binary strings that do not contain two consecutive zeroes
(1|01)*(0|ϵ)

(d) Lowercase alphabet strings that start and end with a vowel (a, e, i, o, u)
(a|e|i|u|o)[a-z]*(a|e|i|u|o)

(e) Alphanumeric passwords with at least one uppercase, one lowercase, or one digit
[A-Za-z0-9]+

Q2. DFA & NFA

(a) DFA for all binary strings representing odd numbers.
Basically, we want binary strings that end with 1

(b) DFA for strings over {a, b} that contain the substring "aba"

(c) DFA for binary strings divisible by 4

(d) DFA for hexadecimal strings representing powers of 2

Q3. Write a Context-Free Grammar for polynomial expressions. Terms can be sorted in any order, for simplicity. Use the ^ character to denote superscript exponents.

First, we have the Terminals

- {+, -, *, /, ^}
- {0,1,2,3,4,5,6,7,8,9} or [0-9]

Then, we have the Non-terminals

$$< \text{polynomial} > ::= < \text{expression} >$$

$$\begin{aligned} < \text{expression} > ::= & < \text{expression} > + < \text{term} > \\ & | < \text{expression} > - < \text{term} > \\ & | < \text{term} > \end{aligned}$$

$$\begin{aligned} < \text{term} > ::= & < \text{term} > * < \text{factor} > \\ & | < \text{term} > / < \text{factor} > \\ & | < \text{factor} > \end{aligned}$$

$$\begin{aligned} < \text{factor} > ::= & < \text{number} > \hat{} < \text{number} > \\ & | < \text{number} > \end{aligned}$$

$$\begin{aligned} < \text{number} > ::= & < \text{digit} >< \text{number} > \\ & | < \text{digit} > \end{aligned}$$

$$< \text{digit} > ::= [0 - 9]$$