Practice Sheet

Regular Expressions

A. Write Regular Expressions for the following languages (Assume that Σ = {0, 1}) -

1. Strings that end in three consecutive 1's.
2. Strings that have at least one 1.
3. Strings that have at most one 1.
4. Strings that contain the substring "101".
5. Strings that do not contain the substring "11".
6. Strings that do not have consecutive 1s.
7. Strings that have neither consecutive 1s, nor consecutive 0s.
8. Strings that may have consecutive 1s, or consecutive 0s, but not both.
9. Strings in which the number of 0s is odd.
10. Strings in which the number of 0s is divisible by four.

B. Write a regular expression for valid email addresses. You have the following information –

- Email addresses have two parts: the user ID (the part before the '@' symbol), and the domain name (the part after the '@' symbol). Ex: lex.luthor@gmail.com [In here, 'lex.luthor' is the user ID, and gmail.com is the domain name.]
- There are only three domains: gmail.com, yahoo.com, and bracu.ac.bd
- All user IDs are made of lower and/or upper class English Letters. A user ID may contain digits, but only if it also contains at least one letter.
- Gmail and Yahoo require users to have user IDs that are of length 5 or more. BRACU allows users to have user IDs of length 1 or more.
- BRACU does not allow users to have user IDs that start with digits. Google or Yahoo has no such restriction.

C. Write a regular expression for the language of all possible complex numbers. [Example of some complex numbers: 4+3i, -406-45i, +10+i, -5+1i etc]

D. Find the shortest string that IS in the language represented by the regular expression: (there are multiple correct answers)

- (a*b|ba*|ab*|ba*|(a*b*))(c*d|cd*|dc*|d*c|(c*d*))((a4|c4)(b4|d4)*

E. Find the shortest string that is NOT in the language represented by the regular expression

- a*b*((ab)*|(ba)*)b*a*

F. Let r1 and r2 be arbitrary regular expressions over some alphabet. Find a simple (the shortest and with the smallest nesting of * and +) regular expression which is equivalent to each of the following regular expressions.

- (r1 + r2 + r1r2 + r2r1)*
- $(r1\ (r1 + r2)^*)^+$

SOME MORE PROBLEMS WITH VIDEO SOLUTIONS

1. Regular Expression of The set of strings that do not end with 11
   https://youtu.be/QYab8RT3M6s
2. Regular Expression of The set of strings that do not contain substring 01
   https://youtu.be/PUXIa4M59Ws
3. Regular Expression of the set of strings having 0 at every 3rd position.
   https://youtu.be/2SgOI03H1fg
4. Describe the language given by the regular expression 0*10*10*1(1|0)*
   https://youtu.be/jUY3_QhFAd4

5. Regular Expression of all strings that are at least of length 4 and contain an even number of 1's
   https://youtu.be/ATEtsdJOd_I