TUTORIAL – 4
(FINITE AUTOMATA & REGULAR LANGUAGES)

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Problem-1

Let A,B be languages over an alphabet Σ, and C = A−B.

Which of the following statements must be true?

(a) If A and B are regular, then C is regular.

(b) If A and C are regular, then B is regular.

(c) If B and C are regular, then A is regular.

(d) If C is regular, then A and B are regular.

Problem-2

Consider the following language over the alphabet {a,b}:

$L_1 = \{ x \in \{a,b\}^* \mid x \text{ starts with ab but does not end with ab } \}$.

(a) Write a regular expression for L_1.

(b) Design a DFA for L_1.

Problem-3

The language $L_2 = \{ uvv'w \mid u,v,w \in \{a,b\}+ \}$ is regular. Here, v' is the reverse of v.

(a) Design a regular expression whose language is L_2.

(b) Convert the regular expression of Part (a) to an equivalent NFA.

(c) Convert the NFA in Part (b) to an equivalent DFA.

(d) Minimize the number of states of the DFA obtained in Part (c).

Problem-4

Construct a regular expression over the alphabet {a,b,c} for

L_3 = { x ∈ {a,b, c}* | x has 4i+1 b's for some integer i >= 0 }.

(a) Construct an NFA from it.

(b) Then, build the equivalent DFA and minimize.

Problem-5

Use Pumping Lemma to prove that the following languages are not regular.

(a) $L_4 = \{ a^{n!} \mid n >= 0 \}$

(b) $L_5 = \{ a^p \mid p \text{ is prime} \}$

Problem-6

Two regular expressions over the same alphabet are called equivalent if they generate the same language.

Prove/Disprove the equivalence of the following pairs of regular expressions over the alphabet {a,b}.

(i) (ab+a)*a and a(ba+a)*

(ii) (ab*a+ba*b)* and (ab*a)*+(ba*b)*

THANK YOU !

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