

MTL783: Theory of Computation

Quiz 1

Time: 50 minutes, 6:10 – 7:00 PM

Date : 09-08-2023

Marks: 12.5

Q1. Consider the following grammar (V, T, P, S) in which

$$V = \{S, A, B, C\}, \quad T = \{a, b\}, \quad P = \{S \rightarrow aS|bS|aA, \quad A \rightarrow bB, \quad B \rightarrow aC, C \rightarrow \varepsilon\}.$$

- (*) Explain in English the language generated by the grammar.
- (ii) Write the regular expression corresponding to the above grammar.
- (iii) Construct an NFA accepting the language generated by the above grammar.
- (iv) Convert this NFA into an equivalent DFA.

[0.5+0.5+1+2.5=4.5]

Q2. Design the finite automata with the following regular expressions. Justify your steps.

- (i) $L_1 = (a|b)^*a(a|b)^*$
- (ii) $L_2 = (a(a|b)^*a)|(b(a|b)^*a)|a|b|\varepsilon$

[1+3=4]

Q3. (i) Prove that the FA whose transition diagram is given in the figure given below accepts the set of all strings over the alphabet $\{a, b\}$ with an equal number of a 's and b 's, such that each prefix has at most one more a than b 's or at most one more b than a 's.

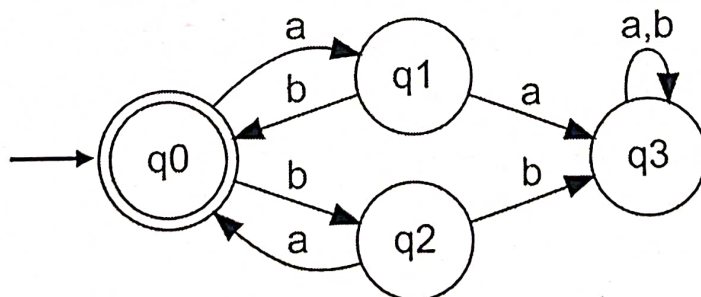


Fig1. Transition diagram for Q3

(ii) Write the regular expression for the FA and corresponding grammar to generate the above language.

Note: Let $w = w_1w_2 \dots w_n$ then for any k , $0 < k \leq n$, prefix of length k is the substring $w_1w_2 \dots w_k$.

[3+1=4]