

Indian Institute of Information Technology Sri City, Chittoor
Theory of Computation – Spring 2023
Mid 1 Examination

Duration: 90 Minutes

Maximum Marks : 60

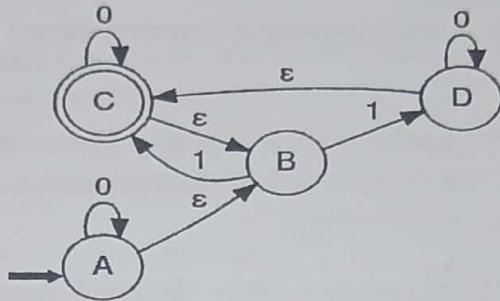
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- It is a closed book exam.
 - No electronic devices, books, any kind of material is allowed.
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1. (a) While it is true that union of two regular languages is a regular language, the following statement is false. "Union of two non-regular languages is a non-regular language." Can you disprove this statement? [5 Marks]
(b) Let L_1, L_2 , and L_3 are languages over an alphabet Σ . Consider the statement : If L_1, L_3 are regular and $L_1 \subseteq L_2 \subseteq L_3$, then L_2 is regular. Prove or disprove this statement. [5 Marks]
(c) Construct a DFA for binary numbers divisible by 2 but not by 3. {Construct a DFA for binary numbers divisible by 2 and and a DFA for binary numbers not divisible by 3; then construct the product machine} [10 Marks]
2. (a) Prove or disprove $0^* = (00)^*(\epsilon+0)$ [4 Marks]
(b) Prove that the following Language is non-regular using Pumping Lemma Theorem
$$L = \{a^n b^m \mid n \geq m\}$$
 [5 Marks]
(c) Write regular expressions for the following languages over the alphabet $\Sigma = \{a, b\}$ [5 Marks]
 - i. Set of strings where in each string **a** followed by 0 or any number of **b**'s
 - ii. Set of strings where each string starts and ends with different symbols
 - iii. Set of strings where each string starts and ends with same symbols
 - iv. Set of strings where each string starts with **a** but do not have two consecutive **b**'s
 - v. Set of strings where each string contains only one **a**

[P.T.O]

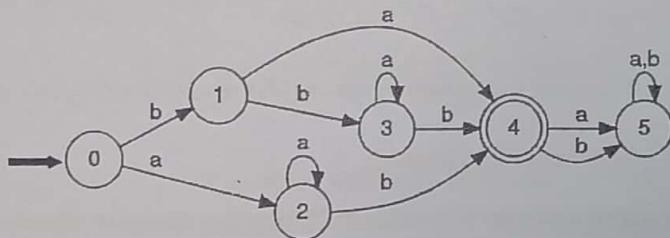
(d) Convert the following NFA (with ϵ transitions) to equivalent DFA, where alphabet $\Sigma = \{0, 1\}$

[6 Mark]

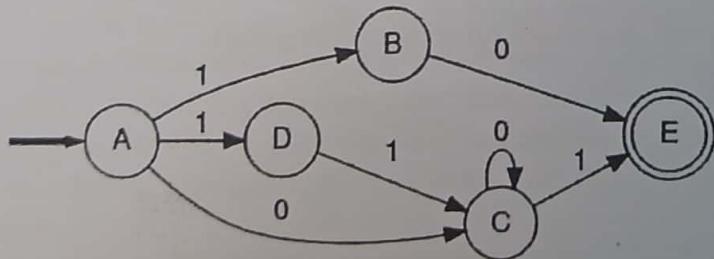


3. Answer the following questions:

- a. Construct the equivalent RE (Regular Expression) for the below FA (Finite Automata) using the state elimination method in the order 0, 1, 2, 3, 4, 5. (Hint: construct GNFA and eliminates states) [7 Marks]



- b. Construct equivalent FA for the regular expression $(10 + 00^*1 + 110^*1)$ [6 Marks]
c. Check the equivalence of the below FA with the FA constructed in 3(b). [7 Marks]



[hint: construct RE for this and check for equivalence of the RE given in 3(b)]

— end —