

This question paper contains 4+2 printed pages]

Roll No.

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S. No. of Question Paper : 6075

Unique Paper Code : 234501

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Name of the Paper : Theory of Computation (CSHT-511)

Name of the Course : B.Sc. (Hons.) Computer Science

Semester : V

Duration : 3 Hours

Maximum Marks : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Question No. 1 (Section A) is compulsory.

Attempt any four questions from Section B.

Parts of a question should be attempted together.

Assume $\Sigma = \{a, b\}$ for all the questions unless specified otherwise.

Section A

1. (a) Is for all sets $(S^+)^* = (S^*)^+$? 2
- (b) Generate a CFG for a^*b^* . 2
- (c) Give Regular expression for all words that do not end in a double letter. 2

P.T.O.

- (d) Define Deterministic Finite Automata. 2
- (e) Design a Deterministic Finite Automata for all strings that either starts with ab or ends with ba. 3
- (f) Give the full details of the following Turing Machines : 3

$>L$ L and $>L \xrightarrow{U} R$

- (g) Convert the following Transition graph into Regular Expression. 4



- (h) Convert the following CFG into CNF : 4

$$S \rightarrow bA \mid aB$$

$$A \rightarrow bAA \mid aS \mid a$$

$$B \rightarrow aBB \mid bS \mid b$$

(i) Show that the language $L = \{a^n b a^{n+1} \text{ where } n = 1 2 3 \dots\}$ is non-regular. 4

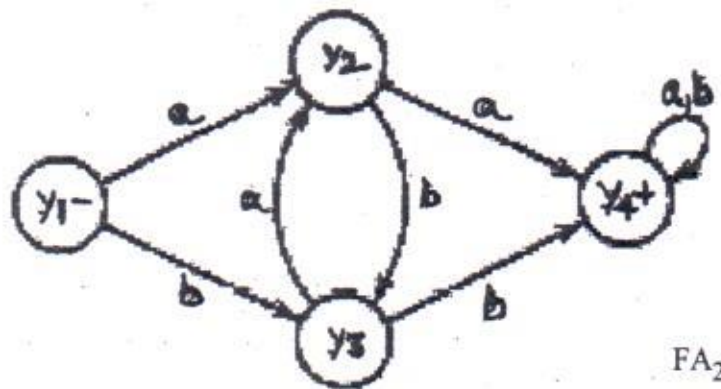
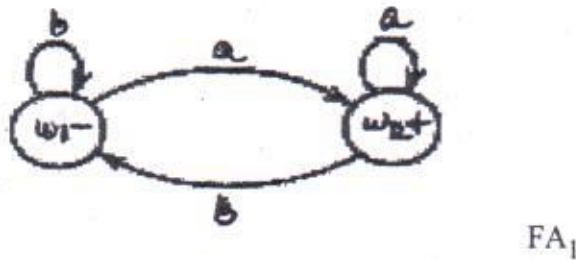
(j) Construct a DFA for the language where every 00 is followed by 1 over alphabet set $\{0, 1\}$. 4

(k) Construct PDA :

$$L = \{a^n b^n c^{n+m} : n \geq 0, m \geq 0\}. \quad 5$$

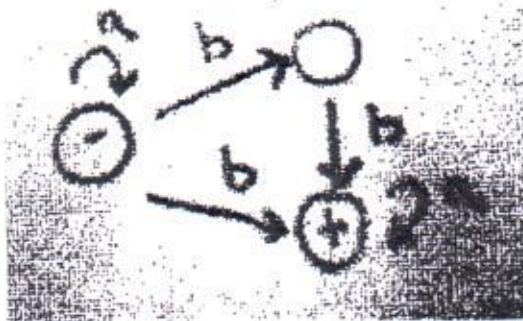
Section B

2. (a) Find the Union Machine for the given FA_1 and FA_2 . 5



(b) Convert the given NFA into DFA.

5



3. (a) Build a DFA and give Regular Expression that define $L_1 \cap L_2$ where :

$$L_1 : (a+b) b (a+b)^*$$

$$L_2 : b (a+b)^*$$

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(b) Show that the language :

$$L = \{a^n b^n a^n b^n a^n \text{ where } n = 1 2 3 \dots\}$$

is non Context Free.

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4. (a) Show the Complement of the Context Free Language may or may not be Context

Free.

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- (b) Show that the CFG is ambiguous :

$$S \rightarrow XaX$$

$$X \rightarrow aX \mid bX \mid \wedge$$

- (a) Explain the Concept of Random Access Turing Machine.

- (b) Explain Halting Problem.

- (c) Give PDA for the language :

$$L = \{a^n b^{2n} \text{ where } n = 1, 2, 3, \dots\}$$

- (a) Show that if L is recursive, then L is also recursively enumerable.

- (b) Design a Turing Machine which gives two's complement of a given input in binary form on the input tape.

- (a) Describe the Language for the following Regular Expressions :

(i) $(a + b)^* ab(a + b)^*$

(ii) $(a(a + bb)^*)^*$

- (b) Build a DFA that accepts all words with exactly four letters.

P.T.O.

T.O.

(c) Trace the following PDA for the given string sequence *aaaabb*.

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