

Roll No.

24266

B. Tech. 5th Semester (CSE)

Examination – December, 2016

THEORY OF AUTOMATA COMPUTATION

Paper : CSE-305-F

Time : Three Hours]

[Maximum Marks : 100

Before answering the question, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Question No 1 is *compulsory* and Attempt at least one question from each of the four sections, all questions carry equal marks.

1. (a) Explain at least four differences between DFA and NFA. 4
- (b) Explain Moore machine with the help of transition table and also draw transition diagram of the given transition table. 4
- (c) Briefly explain any two types of normal forms in CFG. 4

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- (d) Define Turing machine mathematically and also explain its basic structure. 4
- (e) What are UNIT productions in CFG and why they are useless? 4

SECTION - A

2. (a) $M = (\{q_1, q_2, q_3\}, \{0, 1\}, \delta, q_1, \{q_3\})$ is a NFA,

where δ is given by :

$$\begin{aligned} \delta(q_1, 0) &= \{q_2, q_3\}, & \delta(q_1, 1) &= \{q_1\} \\ \delta(q_2, 0) &= \{q_1, q_2\}, & \delta(q_2, 1) &= \{\emptyset\} \\ \delta(q_3, 0) &= \{q_2\}, & \delta(q_3, 1) &= \{q_1, q_2\} \end{aligned}$$

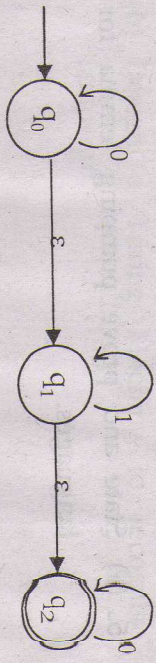
Construct an equivalent DFA. 12

(b) Construct a Melay machine equivalent to given Moore machine : 8

Present State	Next State	Output
	$a = 0$	$a = 1$
$\rightarrow q_0$	q_1	q_2
q_1	q_3	q_2
q_2	q_2	q_1
q_3	q_0	q_3

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3. (a) Remove the ϵ - transition from the given NFA. 10
(Note : By ϵ - closure method only)



(b) Take an example of Melay and Moore machine each and process any string of at least 4 alphabets from these machines and produce the resulting strings. 6

(c) State and prove Arden's theorem. 4

SECTION - B

4. (a) Convert the grammar in GNF.

$$\begin{aligned} S &\rightarrow AA|a \\ A &\rightarrow SS|b \end{aligned}$$

(Note : by taking S as A_1 and A as A_2 method only) 12

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(b) Discuss the ambiguity in CFG with the help of example. 8

5. (a) State and prove pumping lemma for regular languages. 10

(b) Find a reduced grammar equivalent to the grammar G whose productions are: 10

$S \rightarrow AB \mid CA$

$B \rightarrow Bc \mid AB$

$A \rightarrow a$

$C \rightarrow aB \mid b$

SECTION - C

6. (a) Design a PDA for the language

$L = \{ \omega \in (a, b)^* \mid \omega \text{ has equal number of } a\text{'s and } b\text{'s} \}$

Also show the acceptance of string abab with the help of designed PDA. 10

(b) Design a Turing Machine to recognise the language

$L = \{ a^n b^n \mid n \geq 1 \}$

Also perform the trace of the machine by taking a string aabb. 10

7. (a) Design a PDA for the language

$L = \{ \omega \omega^r \mid \omega \in (a, b)^* \}$

(i.e. without marker in the middle) 10

(b) Discuss the halting problem and PCP problem of turing machines. 10

SECTION - D

8. (a) What are Primitive recursive functions ? Show that the following function is primitive recursive :

$$f(x, y) = x - y$$

10

- (b) Show that the CSL's are closed under the following operations :

10

- (i) Union
- (ii) Cocatenation
- (iii) Intersection
- (iv) Substitution

9. (a) Discuss in detail Chomsky hierarchy of grammars and also explain the relation between languages of classes under Chomsky classification with the help of diagram.

10

- (b) Define the following :

10

- (i) Recursive functions
- (ii) Partial Recursive functions
- (iii) Primitive Recursive functions

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