

Total No of Pages: 4

6E6023

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B. Tech. VI-Sem. (Main/Back) Exam., April/May-2016
Computer Science
6CS3A Theory of Computation
Common for IT

Time: 3 Hours **Maximum Marks: 80**
Min. Passing Marks (Main & Back): 26

Instructions to Candidates:-

Attempt any five questions, selecting one question from each unit. All Questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly.
Units of quantities used/ calculated must be stated clearly.
Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL _____
2. NIL _____

UNIT-I

Q.1 (a) $M = (\{q_1, q_2, q_3\}, \{0, 1\}, \delta, q_1, \{q_3\})$ is nondeterministic finite automaton, where δ is given by

[8]

$\delta(q_1, 0) = \{q_2, q_3\}$, $\delta(q_1, 1) = \{q_1\}$
 $\delta(q_2, 0) = \{q_1, q_2\}$, $\delta(q_2, 1) = \phi$
 $\delta(q_3, 0) = \{q_2\}$ $\delta(q_3, 1) = \{q_1, q_2\}$
 Construct an equivalent DFA.

(b) Explain the model of a discrete automaton, also describe its characteristics. [8]

OR

Q.4 Design a Turing machine over $\{1, b\}$ which can compute a concatenation function over $\Sigma = \{1\}$.

If a pair of words (w_1, w_2) is the input, the output has to be $w_1 w_2$. [16]

UNIT-V

Q.5 Explain the model of Linear bounded automaton, also explain the relationship between LBA and context sensitive languages. [16]

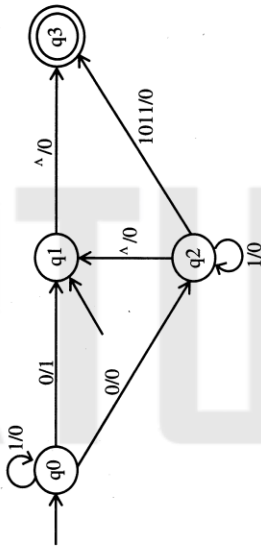
OR

Q.5 Write short note on (any 2):- [8x2=16]

- (a) Chomsky Hierarchy of languages
- (b) Properties of LBA
- (c) Context sensitive languages

OR

Q.1 (a) Describe the block diagram of a finite automaton. Consider the transition system given below.



Determine the initial states, the final state and the acceptability of 101011 and 111010. [8]

(b) Prove that for any transition function δ and for any two input string x and y . $\delta(q, xy) = \delta(\delta(q, x), y)$ [8]

UNIT-II

Q.2 (a) If $G = (\{S\}, \{0, 1\}, \{S \rightarrow 0SI, S \rightarrow \wedge\}, S)$, find $L(G)$ with explanation. [8]

(b) Find the language generated by the grammar $S \rightarrow AB, A \rightarrow A1/0, B \rightarrow 2B/3$. Can the above language be generated by a grammar of higher type? [8]

OR

Q.2 (a) Prove that : $(1 + 00^*1) + (1 + 00^*1)(0 + 10^*1)^*(0 + 10^*1) = 0^*1(0 + 10^*1)^*$ [8]

(b) Consider a finite automaton, with \wedge - moves, given in a figure. Obtain an equivalent automaton without \wedge - moves. [8]



[6E6023]

Page 2 of 4

[6880]

UNIT-III

Q.3 Define pushdown automaton model and its role, also illustrate the move relation in details. [16]

OR

Q.3 (a) Consider the following productions: [8]

$$S \rightarrow a B | b A$$

$$A \rightarrow a S | b A A | a$$

$$B \rightarrow b S | a B B | b$$

for the string $a a b b a b b a$, find

- (i) the leftmost derivation,
- (ii) the rightmost derivation, and
- (iii) the parse tree

(b) Reduce the following grammars in Chomsky normal form: [8]

$$(i) S \rightarrow |A|0B, A \rightarrow |AA|0S|0, B \rightarrow 0BB|S|$$

$$(ii) G = (\{S\}, \{a, b, c\}, \{S \rightarrow a|b|cSS\}, S)$$

$$(iii) S \rightarrow a b S b | a A A b, A \rightarrow b S | a A A b$$

UNIT-IV

Q.4 (a) Explain Turing machine model and its working functions. [8]

(b) Consider the TM description below. Draw the computation sequence of the input string 00. [8]

Present State	Tape Symbol	
	b	0
$\rightarrow q_1$	1 Lq2	0 Rq1
q2	b Rq3	0 Lq2
q3	b Rq4	1 Lq2
q4	0 Rq5	b Rq4
q5	0 Lq2	0 Rq4

[6E6023]

Page 3 of 4

[6880]