

Total No. of printed pages = 4

CSE 181503

Roll No. of candidate

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24/2/22 2021

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#IMT & TIPS)
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B.Tech. 5th Semester End-Term Examination

Computer Science and Engineering

FORMAL LANGUAGE AND AUTOMATA THEORY

(New Regulation & New Syllabus)

Full Marks – 70

Time – Three hours

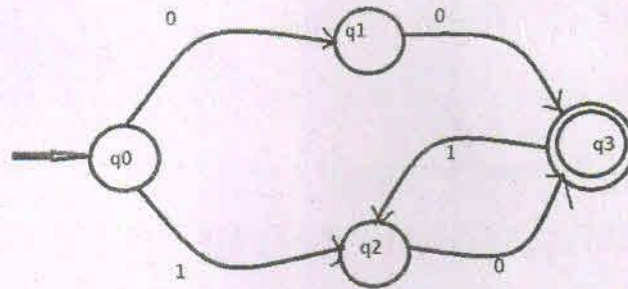
The figures in the margin indicate full marks
for the questions.

Answer question No. 1 and any *four* from the rest.

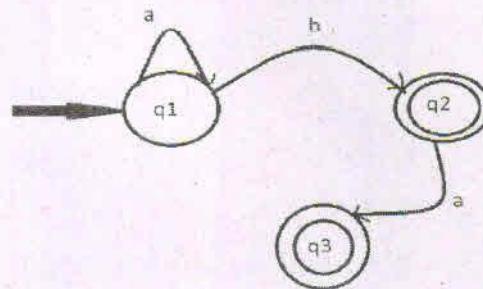
1. Choose the correct option : (10 × 1 = 10)
- (i) In a context-free grammar
- (a) ϵ can be the right hand side of any production
 - (b) terminal symbols can't be present in the left hand side of any production
 - (c) number of grammar symbols in the left hand side is not greater than the number of grammar symbols in the right hand side
 - (d) all of these
- (ii) CFG can be recognized by a
- (a) push-down automata
 - (b) 2-way linear bounded automata
 - (c) both (a) and (b)
 - (d) none of these
- (iii) The production $aAbcD \rightarrow abcDbcd$ is of
- (a) type 0
 - (b) type 1
 - (c) type 2
 - (d) type 3

[Turn over

- (iv) Any given Transition graph has an equivalent
- (a) DFA (b) N DFA
(c) Regular expression (d) All of the given
- (v) Which of the following string is accepted by the DFA?



- (a) 10110 (b) 0011
(c) 101011 (d) 101010
- (vi) The regular expression represented by the given DFA is



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- (a) ab^*aa (b) a^*ba
(c) a^*b+a^*ba (d) ab^*a
- (vii) A given grammar is called ambiguous if
- (a) two or more productions have the same non-terminal on the left hand side
(b) a derivation tree has more than one associated sentence
(c) there is a sentence with more than one derivation tree corresponding to it
(d) brackets are not present in the grammar
- (viii) The intersection of CFL and regular language
- (a) is always regular (b) is always context free
(c) both (a) and (b) (d) need not be regular

(ix) If every string of a language can be determined, whether it is legal or illegal in finite time, the language is called

- (a) decidable (b) undecidable
(c) interpretive (d) non-deterministic

(x) If $\delta(q, x_i) = (p, y, L)$ then

- (a) $x_1x_2\dots x_{i-1}qx_i\dots x_n \mid x_1x_2\dots x_{i-2}px_{i-1}yx_{i+1}\dots x_n$
(b) $x_1x_2\dots x_{i-1}qx_i\dots x_n \mid x_1x_2\dots x_{i-3}px_{i-2}yx_{i+1}\dots x_n$
(c) $x_1x_2\dots x_{i-1}qx_i\dots x_n \mid x_1x_2\dots x_{i-1}ypx_{i+1}\dots x_n$
(d) $x_1x_2\dots x_{i-1}qx_i\dots x_n \mid x_1x_2\dots x_{i+1}pyx_{i+2}\dots x_n$

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2. (a) Construct the grammar accepting the following set. (5)

The set of all strings over $\{a, b\}$ consisting of an equal number of a's and b's.

(b) Reduce the following grammar to CNF : (10)

$$S \rightarrow 1A|0B, A \rightarrow 1AA|0S|0, B \rightarrow 0BB|1S|1.$$

3. (a) Construct a reduced grammar equivalent to the grammar. (5)

$$S \rightarrow aAa, A \rightarrow Sb|bCC|DaA, C \rightarrow abb|DD, E \rightarrow aC, D \rightarrow aDA, F \rightarrow A.$$

(b) Give the formal definition of TM? What are the different types of TMs? Explain. (10)

4. (a) Using pumping lemma show that the set $\{a^n b^n c^n | n > 0\}$ is not context free. (7)

(b) Design a DFA to accept the language. (8)

$$L = \{w | w \text{ is of even length and begins with } 01\}$$

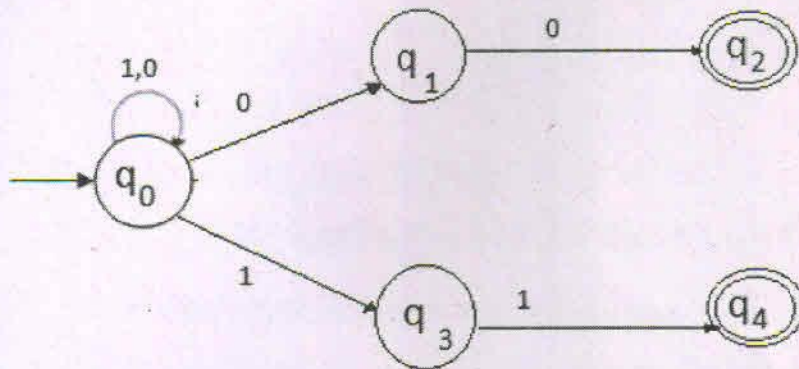
5. (a) Consider the DFA given by the transition table: (8)

δ	0	1
$\rightarrow q1$	q2	q3
q2	q3	q5
*q3	q4	q3
q4	q3	q5
*q5	q2	q5

Construct minimum state equivalent DFA.

(b) Consider the grammar $G(\{S, A\}, \{a, b\}, \{S \rightarrow AS, A \rightarrow aa|ab|ba|bb\}, S)$ and give leftmost and rightmost derivations for the string $aabbba$. Draw the parse tree for the string for leftmost derivation. (7)

6. (a) Convert the given NFA to its equivalent DFA. (6)



(b) Convert the mealy machine given in the following table to its equivalent Moore machine. (7)

Current state	Input symbol			
	a	Output	b	Output
$\rightarrow q_0$	q_0	1	q_2	1
q_1	q_2	0	q_1	1
q_2	q_1	1	q_1	0

(c) Given a grammar $G = (\{S, C\}, \{a, b\}, P, S)$, where P consists of $S \rightarrow aCa, C \rightarrow aCa|b$ then, find $L(G)$. (2)

7. (a) Prove that regular languages are closed under union. (5)

(b) Prove that The union of two recursive languages is recursive and the union of two recursively enumerable languages is recursively enumerable. (10)