

# JK LAKSHMIPAT UNIVERSITY, JAIPUR

## INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination, May 2019

B. Tech in Computer Science Engineering (CSE), Semester VI

Subject Code: CSE504

Roll No.....

Subject Name: Theory of Computation

Time: 3 hours

Max. Marks: 100

### Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.
4. Mapping of each question is done with learning outcome of the course in square bracket, which is circulated in the beginning of semester.

Q.1 Let  $w$  be any string of length  $n$  is  $\{0, 1\}^*$ . Let  $L$  be the set of all substrings of  $w$ . What is the minimum number of states in a non-deterministic finite automaton that accepts  $L$ ? [LO 2] 05

Q2 Draw a deterministic and non-deterministic finite automate which accept 00 and 11 at the end of a string containing 0, 1 in it, e.g., 01010100 but not 000111010. [LO 2] 05

Q3 Draw a deterministic and non-deterministic finite automata which accept a string containing "the" anywhere in a string of  $\{a-z\}$ , e.g., "there" but not "those". [LO 2] 05

Q4 Determine whether the grammar implicitly defined by the following rules is ambiguous. Prove your answer. [LO 3] 05

$$\begin{aligned} S &\rightarrow AB \\ A &\rightarrow aA \\ A &\rightarrow abA \\ A &\rightarrow \varepsilon \\ B &\rightarrow bB \\ B &\rightarrow abB \\ B &\rightarrow \varepsilon \end{aligned}$$

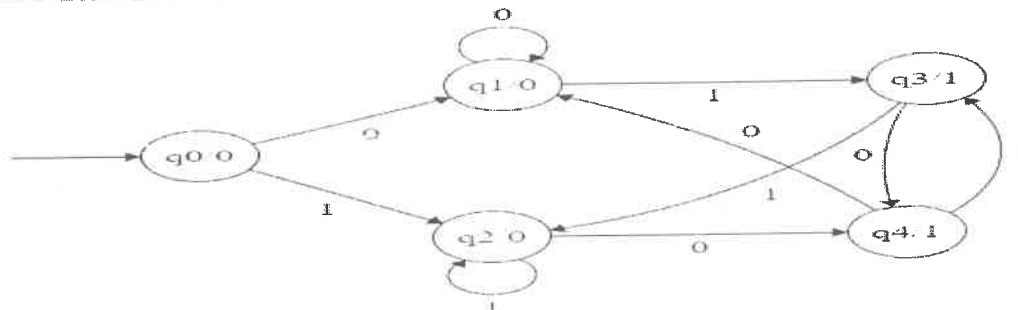
Q5 Consider the following CFG:  $S \rightarrow aB \mid bA \mid D \mid E$   
 $A \rightarrow a \mid aS \mid bAA \mid c$   
 $B \rightarrow b \mid bS \mid aBB \mid c$   
 $D \rightarrow dD \mid Dd \mid d$   
 $E \rightarrow EE \mid EdE$   
(a) Give a left-most derivation of the string aabbcc.  
(b) Give a right-most derivation of the same string.  
(c) Is the grammar ambiguous? Why or why not? 4+3+3 [LO 3]

Q6 Create a pushdown automaton that accepts the language  $\{a^{2n}b^n \mid n > 0\}$ . Show that your PDA accepts aaaabb and that it rejects aaab. [LO 4] 10

Q7 Show that the language defined by  $\{ba^nba^m \mid m > n\}$  is not regular. [LO 1] 5

Q8 Create a pushdown automaton that accepts the language  $\{w \in \{0,1\}^* \mid w \text{ has twice as many 0s as 1s}\}$  [LO 4] 10

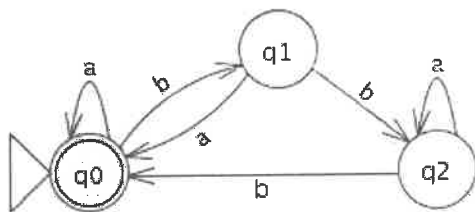
Q9 [LO 5] 5



Convert Moore to Mealy Machine.

Q10 Design a TM to recognize all strings consisting of an odd number of a's. [LO 6] 10

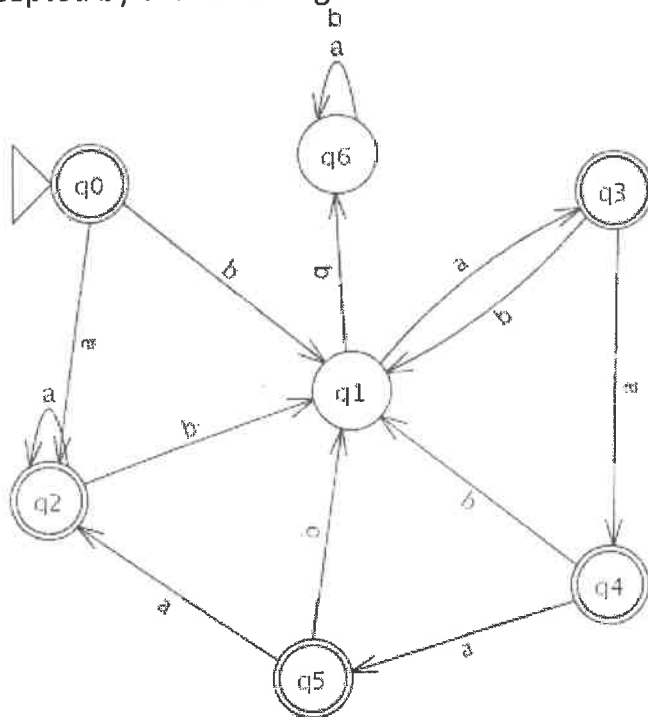
Q11 Find a regular expression that generates the language accepted by the following DFA. Compress the DFA. [LO 1] 10



Q12 Create a context-free grammar that generates the same language as the regular expression  $(a + b)^*(a^* + (ba)^*)$ . [LO 3] 10

Q 13 Find a maximal set of distinguishable strings with respect to the language accepted by the following DFA.

5  
[LO 2]



Q 14 The number of states in the minimal deterministic finite automaton corresponding to the regular expression  $(0 + 1)^*(10)$  is \_\_\_\_\_

5  
[LO 2]

