*Total No. of Questions : 8]* *[Total No. of Printed Pages : 2*

**Roll No** .....

# MCA-304

## M.C.A. III Semester

Examination, November 2018

## Theory of Computation

***Time : Three Hours***

***Maximum Marks : 70***

***Note :*** i) Attempt any five questions.
ii) All questions carry equal marks.

1. a) By using the strong principle of Mathematical induction. Prove that every integer greater than two is either a prime or product of some prime.
   b) Construct Moore machine to calculate residue mod 5 for each ternary string treated as ternary integer.

2. a) State Myhill-Nerode theorem. Give a step-by-step method of constructing minimum automata.
   b) Construct DFA over $\Sigma = \{a, b, c\}$ to accept string. Which starts and ends with different character.

3. a) Construct an NFA with $\in$-move corresponding to the regular expression (a+b)* abab (a+b)*. Convert it to a DFA and minimize it.
   b) Show that $L = \{a^n b^n \mid n \geq 1\}$ is not regular using pumping lemma.

4. a) Construct CFG generating all strings over alphabet {a, b} consisting of equal no. of a's and b's.







   b) Convert the following grammar into GNF
   $E \rightarrow E+T / T$
   $T \rightarrow T^* F / F$
   $F \rightarrow (E) / a$

5. a) Construct npda that accept the language
   $L = a^n b^m \mid n <= m <= 3^n\}$ on $\Sigma = \{a, b\}$.
   b) Find a CFG that generates the language accepted by PDA $M = (\{q_0, q_1\}, \{0, 1\}, \{Z_0, X\}, \delta, q_0, Z_0, \phi)$ with transitions:
   $\delta(q_0, 1, Z_0) = (q_0, XZ_0)$
   $\delta(q_0, 1, X) = (q_0, XX)$
   $\delta(q_0, 0, X) = (q_1, X)$
   $\delta(q_0, t, Z_0) = (q_0, t)$
   $\delta(q_1, 1, X) = (q_1, t)$
   $\delta(q_1, 0, Z_0) = (q_0, Z_0)$

6. a) Construct Turing machine for 2's complement.
   b) Turing machine models the computing capability of a general-purpose computer. Justify with complete example.

7. a) Find the context sensitive grammar for the following language:
   $a^n b^n c^n \mid n \geq 1$
   b) What is undecidability? Describe post's correspondence problem with suitable example.

8. Write short notes on any three of the following:
   a) Linear Bounded Automata
   b) CNF
   c) Chomsky classification
   d) Halting problem of TM
   e) 2DFA

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