

Total No. of Questions :8]

SEAT No. :

P3529

[5560]-181

[Total No. of Pages :2

**T.E. (Computer Engg)**  
**THEORY OF COMPUTATION**  
**(2012 Pattern) (Semester-I)**

Time : 2½ Hours]

[Max. Marks : 70

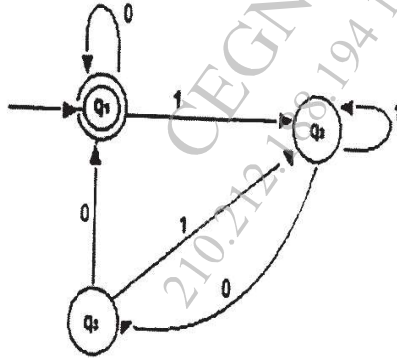
Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right Indicate full marks.
- 4) Assume suitable data, if necessary.

**Q1) a)** Determine the regular expression over the alphabets {a,b} for the following. [6]

- 1) All the strings containing exactly two a's
- 2) All the strings containing ab
- 3) All the strings starting with xx

**b)** Determine the regular expression for following finite automata using Arden's Theorem. [8]



**c)** Prove that  $(1+00^*1)+(1+00^*1)(0+10^*1)^*(0+10^*1)=0^*1(0+10^*1)$ . [6]

OR

**Q2) a)** Construct NFA for the regular expression  $b+ba^*$  [6]

**b)** Prove by Mathematical Induction  
 $2^0+2^1+2^2+2^3+\dots+2^n=2^{n+1}-1$  for all integers  $n \geq 0$  [6]

**c)** Construct CFG for the language  $L=\{0^i1^j2^k \mid j \leq k\}$  [8]

**Q3) a)** Convert the following CFG to chomsky's normal form (CNF) [5]

$S \rightarrow AB, A \rightarrow CA|^\wedge, B \rightarrow DB|^\wedge, C \rightarrow 011|1, D \rightarrow 01$

P.T.O.

- b) Remove the  $\epsilon$  productions from the CFG by preserving meaning of it. [4]

$P = \{S \rightarrow XYX, X \rightarrow OX \mid \epsilon, Y \rightarrow 1Y \mid \epsilon\}$

- c) Write a short note on [9]
- Unrestricted Grammar
  - CFG
  - Derivation Graph

OR

- Q4) a) Construct Finite Automata for [8]

- $01[(10^*)+111^*+0]^*1$
- $1(1+10)^*+10(0+01)^*$

- b) Simplify the following Grammar [10]

- $S \rightarrow Ab, A \rightarrow a, B \rightarrow C \mid b, C \rightarrow D, D \rightarrow E, E \rightarrow a$
- $S \rightarrow 0A0 \mid 1B1 \mid BB, A \rightarrow C, B \rightarrow S \mid A, C \rightarrow S \mid \epsilon$

- Q5) a) What is post machine? Construct a post Machine for strings having odd length and 'a' as a center symbol over  $\Sigma$  (a,b). [6]

- b) What is NPDA? Construct a NPDA for  $L = \{a^i b^j c^k \mid i \neq j \text{ or } j \neq k\}$  [10]

OR

- Q6) a) What do you mean by NP-Complete problems? List all the problems in the class and explain any one in detail. [8]

- b) Why do we need to reduce the given problem to Np-complete problem? Explain with suitable example. [8]

- Q7) a) What is SAT problem? Explain in detail. [8]

- b) What are tractable and Intractable problems? Explain [4]

- c) What is Computational Complexity? Explain. [4]

OR

- Q8) a) Construct TM which accepts even palindrome strings over the  $\Sigma = \{a,b\}$ . [8]

- b) Explain travelling salesperson problem. [8]

