SEAT No. :

P1761

[5460] - 591
T.E. (IT)
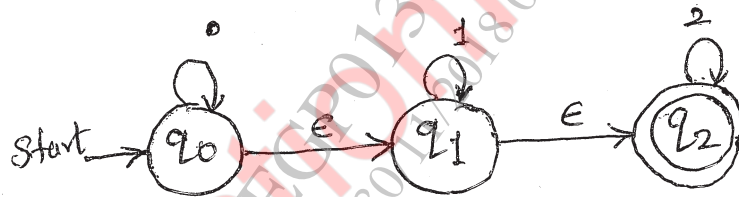## THEORY OF COMPUTATION
(2015 Pattern)

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, Q.9 or Q.10.*

2) *Neat diagrams must be drawn wherever necessary*

3) *Figures to the right, indicate full marks*

4) *Assume suitable data, if necessary*

Q1) a) Convert the NFA with ∈ moves, for the following Transition Diagram, into its equivalent DFA. **[8]**

    b) State properties & limitations of FSM. **[2]**

OR

Q2) a) Find the regular expression for the language **[6]**

    i) Consisting of all strings of a's & b's without any combination of double letters.

    ii) over $\Sigma = \{a, b\}$ containing at least one 'a' & at least one 'b'.

    iii) Consisting of set of all strings that start with 'a' and do not have two consecutive 'b's.

    b) Construct Transition Graph for the following regular expression. **[4]**

$$r = 1^* \cdot 0 \cdot 0 \cdot (0 + 1)^*$$

P.T.O.

Q3) a) Write a context free language (CFL) for the following CFG. **[6]**

    i) $S \rightarrow OSO \mid A \mid \in$

        $A \rightarrow 1SO \mid \in$

    ii) $S \rightarrow a\ Sc \mid A \mid \in$

        $A \rightarrow aAb \mid \in$

  b) Eliminate $\in$ - productions from the given Grammar consisting of following productions **[4]**

     $S \rightarrow a\ S\ a \mid b\ S\ b \mid \in$

<div align="center">OR</div>

Q4) a) Convert the following grammar G to GNF **[8]**

     $G = \{(A_1\ A_2\ A_3),\ (a,\ b),\ P\ ,\ A_1\}$

     Where P consists of the following productions :

     $A_1 \rightarrow A_2\ A_3$

     $A_2 \rightarrow A_3\ A_1 \mid b$

     $A_3 \rightarrow A_1\ A_2 \mid a$

  b) State applications of Context - free Grammar. **[2]**

Q5) a) Define PDA. Construct PDA that accepts the following language. **[8]**

     $L = \{a^n b^n\ /\ n > 0\}$

     Simulate for $\omega = aaabb$

  b) Construct a PDA that accepts the following language. **[8]**

     $L = \{X, aXa, bXb, aaXaa, abXba......\}$

<div align="center">OR</div>

Q6) a) Construct PM that multiplies two unary numbers write simulation for **[10]**

    i)   aa.a

    ii)   aaa.aaa

  b) Give difference between PDA & PM. **[6]**

Q7) a) Design a TM that recognizes strings containing equal no. of 0's & 1's Write simulation for any two input strings. **[9]**

  b) Design a TM that recognizes binary palindromes. Write simulation for any two input strings. **[9]**

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Q8) a) Design TM that finds the Greatest Common Divisor (GCD) of two given numbers. Find GCD of 4 & 2. **[12]**

b) Write short note on types of TM. **[6]**

Q9) a) Prove that.

PCP = {<p> |p is an instance of the Post Correspondence problem with a match}. **[10]**

b) Write short note on p - class with examples. **[6]**

OR

Q10) a) Prove that following are decidable languages. **[10]**

i) A_{NFA} = {<B, ω> | B is an NFA that accepts input string ω}

ii) A_{REX} = {<R,ω> | R is a regular expression that generates string ω}

b) Explain computational complexity with example. **[6]**

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