

[5353]-181

T.E. (Computer) (Semester - I)

THEORY OF COMPUTATION

(2012 Pattern)

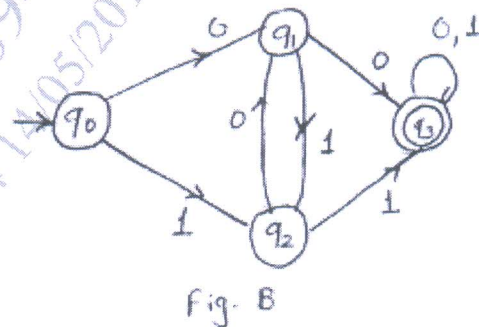
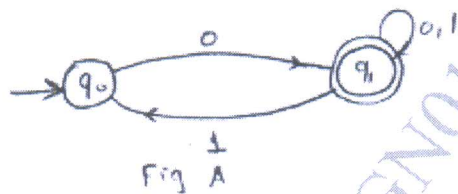
Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

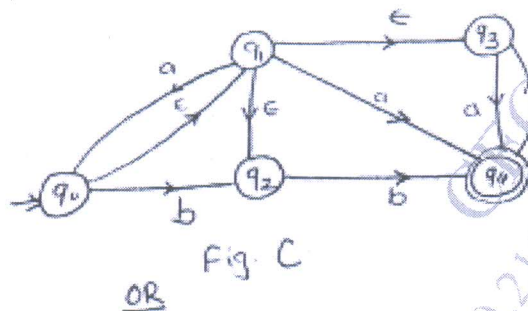
Q1) a) Find the regular expression for the DFA shown in the fig A and fig B. [6]



b) Define pumping Lemma. [6]

Show that the language given is not regular  $L = \{ww^R | w \in \{a,b\}^*\}$ 

c) Define deterministic finite automata. [8]

Find the equivalent DFA for  $\epsilon$ -NFA given in fig C.

OR

**Q2) a)** Define equivalence relation [6]

Whether the relation  $R = \{(x, y) \rightarrow N \mid x \leq y\}$  is equivalence relation.

**b)** Define regular expression. [6]

Construct the context free grammar corresponding to regular expression

$$R = (0 + 1)1^*(1 + (01)^*)$$

**c)** Convert the given grammar to equivalent CNF [8]

$$S \rightarrow PQP$$

$$P \rightarrow OP \mid \epsilon$$

$$Q \rightarrow 1Q \mid \epsilon$$

**Q3) a)** Define : Language accepted by Turing Machine Design the turing machine for checking well formedness of parenthesis. [10]

**b)** Write short notes on (any two): [8]

i) Universal Turing Machine

ii) Undecidability

iii) Church Turing Machine

OR

**Q4) a)** What is Turing Machine? [10]

Design the turing machine which accepts set of all palindromes over  $\{0,1\}$ . Use ID representation to show acceptance of  $w = 10101$ .

**b)** What is Post Machine? Give the formal definition. Construct a post machine accepting a string for language a's & b's. [8]

**Q5) a)** Define Push Down Automata. [8]

Construct PDA that accepts

$$L = \{a^i b^j c^k \mid i, j, k \geq 0 \text{ \& } i + j = k\} \text{ through final state.}$$

- b) Obtain CFG for the PDA given below [8]

$P = (\{q_0, q_1\}, \{a, b\}, \{a, b, z_0\}, \delta, q_0, z_0, \phi)$  where  $\delta$  is

$$\delta(q_0, a, z_0) = \{(q_0, az_0)\} \quad \delta(q_1, b, a) = (q_1, \epsilon)$$

$$\delta(q_0, a, a) = \{(q_0, aa)\} \quad \delta(q_1, \epsilon, z_0) = (q_1, \epsilon)$$

$$\delta(q_0, b, a) = \{(q_1, \epsilon)\}$$

OR

- Q6) a) Define [8]

- i) Non Deterministic Pushdown Automata (NIPDA)
- ii) Instantaneous Description of PDA with suitable example.
- iii) Language Acceptance by different ways

- b) Construct PDA equivalent to following CFG [8]

$$S \rightarrow OBB$$

$$B \rightarrow OS|1S|0$$

Test if  $010^4$  is in language

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

- b) Elaborate on Tractable and Intractable problems. [8]

OR

- Q8) a) Explain with suitable example - Node cover problem. [8]

- b) Why do we need to reduce existing problem to NP complete problem, explain with example. [8]

