

Total No. of Questions :12]

SEAT No. :

[Total No. of Pages :5

P1667

[5058] - 155

T.E. (Computer Engg.)

THEORY OF COMPUTATION

(2008 Pattern) (Semester - I)

Time : 3 Hours]

[Max. Marks :100

Instructions to the candidates:

- 1) *Attempt Q.1 or 2, Q.3 or 4, Q.5 or 6, Q.7 or 8, Q.9 or 10, Q.11 or 12.*
- 2) *Answer to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

SECTION - I

Q1) a) Design a DFA accepting language. [8]

$L = \{w \mid w \text{ is of the form } x01y \text{ for some strings } x \text{ and } y \text{ consisting of } 0\text{'s} \text{ and } 1\text{'s} \text{ only}\}$

b) Design a Mealy machine that accepts strings endings with '00' and '11'. [8]

c) Define following terms with example. [2]

- i) Symbol
- ii) Alphabet

OR

Q2) a) Define following terms with examples. [8]

- i) DFA
- ii) NFA
- iii) Moore Machine
- iv) Mealy Machine

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- b) Consider the following NFA with ϵ transitions. Convert this NFA to DFA. [8]

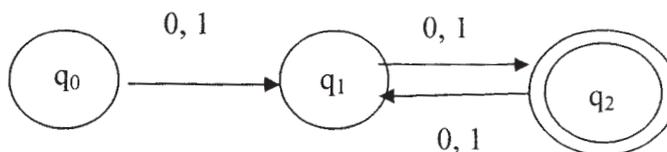
	ϵ	a	b	c
p	-	p	q	r
q	P	q	r	-
r	P	r	-	p

- c) Prove that $(a + b)^* = (a + b)^* \cdot (a + b)^*$ [2]

- Q3)** a) Find Regular Expressions for the given sets: [8]

- i) The set of all strings over $\{a, b\}$ which end in ab.
- ii) The set of all strings over $\{a, b\}$ which start with ab and end with ba.
- iii) The set of all strings over $\{0, 1\}$ which contains 100 as substring.
- iv) If $L(r) = \{a, c, ab, cb, abb, cbb, abbb, \dots\}$ what is r?

- b) Consider the following transition diagram and convert it to its equivalent regular expression. [8]



OR

- Q4)** a) Construct a DFA for the given Regular Expression. [8]

$$(11 + 0)^* (00 + 1)^*$$

- b) Write a short note on Applications of Regular Expressions. [4]
- c) For the following regular expression, draw an FA recognizing the corresponding language. $r = (1 + 10)^*0$ [4]

Q5) a) Describe the language generated by grammars. **[8]**

i) $S \rightarrow aA / bC / b$

$$A \rightarrow aS / bB$$

$$B \rightarrow aC / bA / a$$

$$C \rightarrow aB / bS$$

ii) $S \rightarrow bS / aA / \epsilon$

$$A \rightarrow aA / bB / b$$

$$B \rightarrow bS$$

b) What do you mean by ambiguous grammar? **[8]**

Let G be a grammar:

$$S \rightarrow aB|bA$$

$$A \rightarrow a|aS|bAA$$

$$B \rightarrow b|bS|aBB$$

For the string “aaabbabbba” find:

Leftmost and Rightmost derivations.

Also draw derivation trees.

OR

Q6) a) Find Right Linear Grammar for given Left Linear Grammar. **[8]**

$$S \rightarrow B1|A0|C0$$

$$A \rightarrow C0|A1|B1|0$$

$$A \rightarrow B1|1$$

$$C \rightarrow A0$$

b) Consider the grammar G with productions. Find an equivalent grammar in CNF. **[8]**

$$S \rightarrow aB/bA$$

$$A \rightarrow a/aS/bAA$$

$$B \rightarrow b/bS/aBB$$

SECTION - II

- Q7)** a) Define following: **[10]**
- i) ID of PDA.
 - ii) PDA by empty stack.
 - iii) DPDA V/S NPDA.
 - iv) Two stack PDA with diagram.
 - v) PDA by final state.
- b) Design a PDA to accept the language $S + S * S$. Simulate the working of above PDA for String. $4 + 4*4$. **[8]**

OR

- Q8)** a) Design a PDA to check the well formedness of paranthesis. **[6]**
- b) Construct PDA by null store for following grammar G. **[6]**
- $S \rightarrow CS1/A$
 $A \rightarrow 1AC/S/\epsilon$
- c) Give grammar for following PDA operations. **[6]**
- $\delta(q_0, o, Z) = (q_0, AZ)$
 $\delta(q_0, 1, A) = (q_0, AA)$
 $\delta(q_0, o, A) = (q_1, \epsilon)$

- Q9)** a) Design a TM to accept the string which ends in 'abb' where $L(M) = \{W \in \{a, b\}^* / W \text{ ends in } abb\}$. Simulate with example. **[8]**
- b) Define following terms: **[8]**
- i) Solvability.
 - ii) Semisolvability.
 - iii) Unsolvability.
 - iv) Formal difinition of T.M.

OR

- Q10)**a) Design a post machine for $\{a^n b^{2^n} / n > 0\}$ [4]
- b) Explain following: [8]
- i) Programming techniques to TM.
 - ii) Extension to T.M.
- c) Design a T.M. to accept the language $L(M) = \{a^n b^n / n \geq 1\}$ [4]

- Q11)**a) Write short note on following: [8]
- i) Post correspondence problem.
 - ii) Universal Turing machine
- b) State the following: [8]
- i) Reduction with example.
 - ii) Totality problem with example.

OR

- Q12)**a) Write short note on following: [8]
- i) Modified PCP problem.
 - ii) Recursive and recursively Enumerable language.
- b) State the halting problem. Prove that halting problem of T.M. is undecidable with the help of example. [8]

