B.E. (Computer Engineering) Fifth Semester (C.B.S.)

Theory of Computation

P. Pages : 3 **NRT/KS/19/3444**

Time : Three Hours * 0 1 4 8 * Max. Marks : 80

Notes : 1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.

1. a) Explain the following term **any four.** **4**

i) + Closure

ii) String

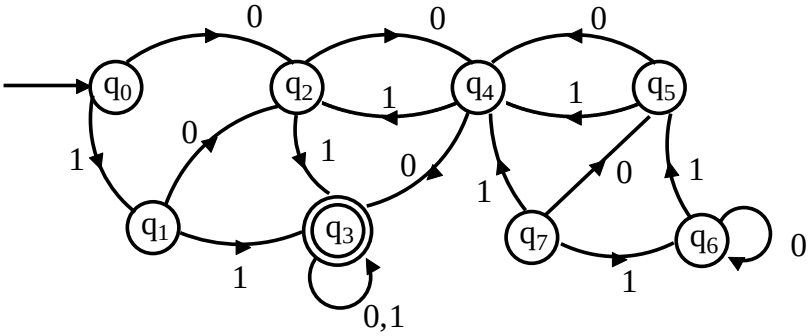
iii) Proper Prefix

iv) Super set

v) Sub set

vi) Sub sequence

b) Optimize the following finite Automata. **9**



OR

2. a) Explain the working model of finite Automata. **4**

b) Design F.A. to accept all the string which is divisible by 5. Consider input as binary number i.e. (0, 1). **4**

c) Design a Mealay and Moore machine which calculate 2's compliment of Binary number. **5**

3. a) Convert the following regular Expression into DFA. **7**

$$(0+1)^{*}100(01)^{*}+10$$

b) Write a short note on Chomsky Hierarchy of a language in details. **7**

OR

4. a) Prove that given language is not regular. **7**

$$L = \left\{ a^{i^3} \mid i \geq 1 \right\}$$

b) Convert the following right linear grammar into its Equivalent left linear grammar. **4**

$S \rightarrow 0A \mid 01 \mid 11B$

$A \rightarrow 110 \mid 1A \mid 0B$

$B \rightarrow 10 \mid 1S$

c) Prove that **any one.** **3**

i) The Difference of two regular set is regular.

ii) The reversal of regular set is regular.

5. a) Convert the following CFG into GNF : **7**

$S \rightarrow AA \mid 00$

$A \rightarrow SS \mid 11$

b) Design a PDA for the following language : **7**

$$L = \left\{ w \subset w^R \middle/ \begin{matrix} w \in (a,b)^* \text{and} \\ w^R \text{ is a reverse of } w \end{matrix} \right\}$$

OR

6. a) Show whether the given grammar is ambiguous or not : **3**

$S \rightarrow a \mid Sa \mid bbS \mid SbS$

b) Optimize the following CFG : **4**

$S \rightarrow Ba \mid Saa \mid bB$

$A \rightarrow aaA \mid \in$

$B \rightarrow SaB \mid a \mid C$

$C \rightarrow a$

c) Convert the following PDA to CFG. **7**

$\delta(q_0, a, z_0) = (q_0, a\, z_0)$

$\delta(q_0, a, a) = (q_0, a\, a)$

$\delta(q_0, b, a) = (q_1, \in)$

$\delta(q_1, b, a) = (q_1, \in)$

$\delta(q_1, B, z_0) = (q_1, z_0)$

7. a) Explain various type of Turing machine. **6**

b) Design a Turing machine for the following language. **7**

$$L = \left\{ a^n b^n c^n \,|\, n \geq 1 \right\}$$

OR

8. a) Write a short note on linear bounded Automata. **6**

b) Design a T.M. to multiply two unary number. **7**

9. Explain the following : **13**

i) Church's Hypothesis
ii) Halting problem of Turing Machine.
iii) Primitive recursive function.

OR

10. a) Compute the following by using Ackerman function. **7**

$$A(1,1),\ A(2,2),\ A(2,1)$$

b) Explain the post correspondence problem. And show the PCP solution for the following list. **6**

$$X = \{10, 01, 0, 100, 1\}$$
$$Y = \{101, 100, 10, 0, 010\}$$

11. a) Explain the following with suitable example. **8**

i) TURING COMPUTABLE Function
ii) μ-recursive function.

b) Write and explain bounded and unbounded minimalization. **5**

OR

12. a) Show that function f is primitive recursive function. **7**

$$f(x, y) = x^y$$

b) Explain the following complex and basic primitive recursive function with example of each. **6**

i) Zero function ii) Successor function
iii) Projection function iv) Composition

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