B.E. (Information Technology) Fourth Semester (C.B.S.)

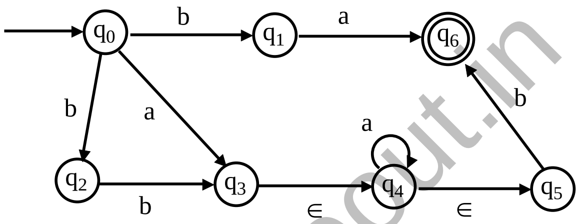
Theory of Computation Paper - III

P. Pages : 3 **TKN/KS/16/7388**

Time : Three Hours 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.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.

1. a) Construct on NFA without $\in$-moves corresponding to the following NFA. **7**



b) Design a mealy and moore machine that recognizes the double occurrence of symbols 'a' in input string $s \in \Sigma^*$ where $\Sigma = \{a, b\}$. **7**

OR

2. a) Consider the mealy machine given by following transition table. Construct a moore machine equivalent to this given mealy machine. **7**

P. S.	N. S.			
	a = o	O / P	a = 1	O / P
→ q_1	q_3	1	q_2	0
q_2	q_1	1	q_4	1
q_3	q_2	0	q_1	1
q_4	q_4	1	q_3	0

b) Convert following NFA to DFA **7**

P. S.	N. S.	
	a = 0	a = 1
→ q_0	q_0, q_1	q_2
q_1	q_0	q_1
q_2	q_1	q_0, q_1

3. a) Give a nondeterministic finite automat on that accepts the language generated by the expression $(a+ba+baaa)^*$ **7**

b) Show that the language defined by: **7**

i) $L = \{ba^n \ ba^m / m > n\}$

ii) $L = \{a^n \ b^m / n, m \text{ are positive integers}\}$

is not regular.

OR

4. a) Construct transition diagram for regular expression **7**

i) $R = (ab^*)\ (a+b)^*\ (b+ab)$

ii) $R = (0+1)^*\ (010+101)\ (0+1)^*$

b) Consider the following productions of the regular grammar G: **7**

$S \to aA \mid a$

$A \to aA \mid aB \mid a$

$B \to bB \mid c$

Find the regular expression corresponding to regular grammar G.

5. a) Consider the context free G_1 that consist of following production: **7**

$S \to aB \mid bA$

$A \to a \mid aS \mid bAA,$

$B \to b \mid bS \mid aBB$

for the string a a bba ba b, find

i) Leftmost derivation

ii) Rightmost derivation

iii) Parse tree

b) Reduce the following grammar into Greibach normal form **6**

$S \to a \mid AA \mid BA$

$A \to a \mid AB \mid b$

$B \to a$

OR

6. a) Create a pushdown automaton that accepts the language $\{a^{2n} \ b^n / n > 0\}$. Show that PDA accepts aaaa bb and that it rejects a aa b. **7**

b) Determine whether the grammar implicitly defined by the following rules is ambiguous. If the grammar is ambiguous, determine whether the language it generates is inherently ambiguous. **6**

$S \to AB$

$A \to aA \mid abA \mid \in$

$B \to bB \mid abB \mid \in$

7. a) Write in detail different types of Turing machine. **7**

b) Construct a Turing machine that produces 2's complement of input binary sequence. **6**

OR

8. a) Design a Turing machine to accept the language $L = \left\{0^n\ 1^n\ 2^n \middle/ n \geq 0\right\}$. **7**

b) Write short note on: **6**
   i) LBA
   ii) Counter machine.

9. a) Write short notes on: **6**
   i) Post correspondence problem.
   ii) Church's hypothesis.

b) Ackermann's function is defined by **7**

$$A(o, y) = y + 1$$
$$A\ (x+1,\ 0) = A\ (x, 1)$$
$$A\ (x+1\ ,\ y+1) = A(x, A(x+1)\, y))$$

Compute:
   i) A (1 , 1),
   ii) A (1 , 2),
   iii) A (1 , 3).

OR

10. a) State which of the following PCP's have a solution: **7**
   i) $\{(01,\ 011), (1,10), (1,11)\}$
   ii) $\left\{(b^3,\ ab^2),\ (b^3,\ bab^3)\right\}$

b) Explain properties of Recursive and Recursively enumerable language. **6**

11. a) Show that function $f(x, y) = x + y$ is Primitive recursive. **6**

b) Write short notes on : **7**
   i) Bounded minimalization.
   ii) unbounded minimalization.

OR

12. a) Explain mod and div function with example. **6**

b) What do you mean by primitive recursive function over n and over a, b? **7**

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