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

Theory of Computation Paper – III

P. Pages : 3 **KNT/KW/16/7300**

Time : Three Hours * 0 1 6 6 * Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve **six** questions as follows.
3. Que. No. 1 OR Que. No. 2.
4. Que. No. 3 OR Que. No. 4.
5. Que. No. 5 OR Que. No. 6.
7. Que. No. 7 OR Que. No. 8.
8. Que. No. 9 OR Que. No. 10.
9. Que. No. 11 OR Que. No. 12.
8. Illustrate the answers with necessary figures/drawings wherever necessary.
9. Assume suitable data wherever necessary.

1. a) Consider the following $\in$-NFA. **8**

	$\in$	a	b	c
→ p	ϕ	{p}	{q}	{r}
q	{p}	{q}	{r}	ϕ
*r	{q}	{r}	ϕ	{p}

i) Compute the $\in$-closure of each state.

ii) Give all the strings of length three or less accepted by the automaton.

iii) Convert the automaton to a DFA.

b) Define the following with suitable example:- **6**
i) Language
ii) String
iii) Null string.

OR

2. a) Consider the language L of all strings of a's and b's that do not end with b and do not contain the substring bb. Find a finite language S so that L = S*. **6**

b) Compare Moore machine with mealy machine. Construct mealy machine equivalent to the Moore machine given below. **8**

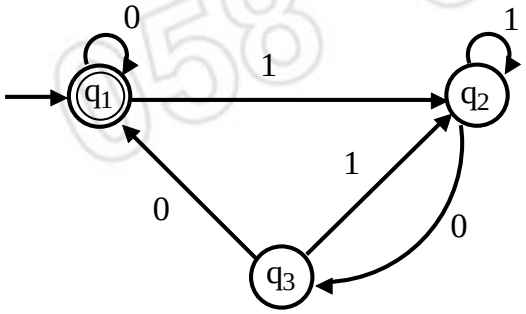
Present state	Next State		Output
	b = 0	b = 1	
r_0	r_3	r_1	0
r_1	r_1	r_2	1
r_2	r_2	r_3	0
r_3	r_3	r_0	0

Table 2.b Moore Machine

3. a) State the pumping Lemma for regular languages. Consider the language, L given below and prove using pumping lemma, L is not a regular language. **6**

$L = \left\{ 0^{i^2} \mid i \geq 1 \right\}$.

b) Construct a regular expression corresponding to the state diagram given below:- **7**



OR

4. a) Explain the Chomsky hierarchy of languages. For each also write the appropriate grammar. **6**

b) Write the steps used to convert the Right linear grammar into Left linear grammar. Convert the following Right linear grammar to left linear grammar : - **7**

$S \rightarrow aB \mid bC$

$B \rightarrow aD \mid bB \mid a$

$C \rightarrow bC \mid bB \mid b$

$D \rightarrow a \mid aB$

5. a) Convert the grammar given below into Greibach Normal form. **6**

$S \rightarrow XY$

$X \rightarrow YS \mid i$

$Y \rightarrow SX \mid q$

b) Show that the grammar given below are ambiguous. **7**

i) $S \rightarrow a \mid ab\,Sb \mid aAb$

$A \rightarrow bS \mid aAAb$

ii) $S \rightarrow 0B \mid 01$

$A \rightarrow 0AB \mid 0$

$B \rightarrow AB1 \mid 1$

OR

6. a) Construct a PDA for the following languages. **7**

i) $L = \left\{ a^n b^{n+m} a^m \mid n, m \geq o \right\}$

ii) $L = \left\{ W \subset W^R \;\middle|\; \begin{array}{l} w \in (a \mid b)^* \\ w^R \text{ is reverse of } W \end{array} \right.$

b) Write the closure properties of context - free languages, if L_1 and L_2 are context - free languages. **6**

7. a) Construct a Turing machine that will accept the following language on {0, 1} **6**
$L = \{0^m 1^{2m} : m \geq 1\}$.

b) Design a Turing machine that performs one's complement of the binary number. **7**

OR

8. a) What do you mean by Restricted Turing machine? With the help of neat diagram, write about the working of multistack machines. **6**

b) Construct a context sensitive grammar for the language, M given below :- **7**
$M = \{x^\ell y^\ell z^\ell \mid \ell \geq 1\}$.

9. a) What is the difference between recursive languages and recursive enumerable languages? And, show that the recursive and recursive enumerable languages closed under property of union. **8**

b) Prove that post correspondence problem with two lists **6**
ℓ = (ab, b, b)
m = (ab^3, ba, b^2)
has no solution.

OR

10. a) Given an arbitrary Turing machine M over alphabet Σ = {a, b}, and an arbitrary string ω over Σ, does M halt when it is given ω as an input? **7**
Show that the halting problem is not decidable.

b) Explain the concept of Church's hypothesis. **6**

11. a) What is primitive recursive function? Find two functions g and h so that the function f defined by f (x) = x^2 is obtained from g and h by primitive recursion. **7**

b) "If unbounded minimalization applied to a primitive recursive predicate yields a total function, the function is primitive recursive." True or false. Justify your answer. **6**

OR

12. a) Show that the operations multiplication and addition are primitive recursive. **7**

b) Explain with neat sketch unbounded minimalization. **6**

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