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

# Theory of Computation

P. Pages : 3 **NKT/KS/17/7300**

Time : Three Hours * 0 3 1 3 * Max. Marks : 80

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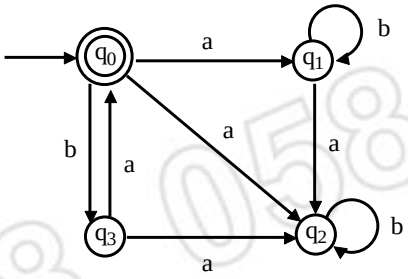
Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Illustrate your answers whenever necessary with the help of neat sketches.

**1.** a) Design DFA to check whether the given binary number is divisible by 5. **6**

b) Convert the following NFA into equivalent DFA. **7**




**OR**

**2.** a) Design a mealy machine to count no. of occurrence of "ab" and convert the resultant machine into Moore M/c **8**

b) Define the following with suitable example. **5**

i) Language. ii) String.
iii) NULL String. iv) Prefix.
v) Suffix.

**3.** a) Construct a optimized DRA corresponding to the regular expression given below **7**

$$\underline{(a+b)^* aa(a+b)^* +}$$

$$\underline{(a+b)^* bb(a+b)^*}$$

b) Obtain the regular expression from following grammar. **3**

$S \rightarrow 1A \mid 0C \mid 0$

$A \rightarrow 1B$

$B \rightarrow 1B \mid 1D$

$C \rightarrow 0$

$D \rightarrow 0D \mid 01$

c) Answer following. **4**

i) Unrestricted grammar is also a context free grammar.

a) True b) False

ii) Which of the following is types 0 but not type 1 & why?

i) $S \rightarrow E$ ii) $S \rightarrow aaB|ab|a$

iii) $abSa \rightarrow abA$ iv) $aS \rightarrow abaS$

**OR**

**4.** 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. **7**

$L = \{ a^n \ b^{n+1} | n > 0 \}$.

b) Write the steps used to convert the Right linear grammar into Left linear grammar. **7**

Convert the following right linear grammar to left linear grammar:-

$S \rightarrow aaA/bc$

$A \rightarrow bbB/b$ .

$B \rightarrow cA/c$

**5.** a) Design a PDA to accept all string over $L = ( a^n \ b^m \ c^{|m-n|} | m, n >= 1 )$ with all possible condition. **7**

b) Write the closure properties of context free languages. If $L_1$ and $L_2$ are context – free languages. **6**

**OR**

**6.** a) Convert the following in CNF: **7**

$S \rightarrow AB\,a \mid b$

$A \rightarrow bb\,A \mid B$

$B \rightarrow a\,A\,a$

b) Construct PDA from the given grammar. **6**

$E \rightarrow \ +EE \mid *EE \mid \$TF$

$T \rightarrow \ +T \mid +$

$F \rightarrow \ *F \mid +$

**7.** a) Construct a Turing machine accepting the language $L = \{a^n \ b^{2n} \ c^n | n \geq 1\}$ **8**

b) Explain the concept of linear Bounded Auto mata. **6**

**OR**

**8.** a) Explain the types of Turing machine. **7**

b) Design a Turing machine That performs Two's Complement of the binary number. **7**

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

b) Explain the properties of Recursively Enumerable language. **7**

**OR**

**10.** a) Define Ackerman's function & compute. **6**
A(1,1), A(2,1) and A (2,2)

b) Explain the following terms.
1) Halting problem. **4**
2) Post Correspondence problem. **3**

**11.** a) Explain the following terms.
1) $\mu$-recursive function. **4**
2) Primitive recursive function. **4**

b) Write short notes on: **5**
i) Bounded minimalization.
ii) Un Bounded minimalization.

**12.** a) Consider the function. **6**
equals (x, y) = 1 if x = y
= 0 if $x \neq y$
Show that this function is primitive recursive.

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

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