Total No. of Questions : 10]

SEAT No. :

P3388

[Total No. of Pages : 3

[5353] - 591

T.E. (IT)

THEORY OF COMPUTATION

(2015 Pattern)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data if necessary.*

Q1) a) Define pumping lemma. Prove that the language $L=\{a^n b^{n+1} | n>0\}$ is non regular. **[6]**

b) Construct FSM for divisibility by 3 tester for binary number. **[4]**

OR

Q2) a) Construct the Mealy machine to accept strings ending with '00' or '11' over $\Sigma=\{0,1\}$. Convert Mealy Machine into equivalent Moore machine. **[8]**

b) If $L(r)=\{\in, x, xx, xxx, xxxx, xxxxx\}$ What is r? **[2]**

Q3) a) Simplify the following grammar **[5]**

$S \rightarrow a | Xb | aYa$

$X \rightarrow Y | \in$

$Y \rightarrow b | X$

b) Write an equivalent left-linear grammar for the right-linear grammar which is defined as : **[5]**

$S \rightarrow 0A | 1B$

$A \rightarrow 0C | 1A | 0$

$B \rightarrow 1B | 1A | 1$

$C \rightarrow 0 | 0A$

P.T.O.

OR

Q4) a) Check whether or not the following grammar is ambiguous : if it is ambiguous, remove the ambiguity and write an equivalent unambiguous grammar $E \to E+E|E-E|E*E|E|E|(E)|id$ **[6]**

b) Convert the given CFG $G=(\{s\},\{a\},p,s)$ into CNF. **[4]**

$S \to aaaaaS|aaa$

Q5) a) Construct PDA to accept the strings containing equal no. of a's & b's over $\Sigma=\{a,b\}$ **[8]**

Write ID for

i) $abbaab$.

ii) $aabb$.

b) Design a PM that checks if the given string contains well-formed parenthesis. **[8]**

Simulate for

$(()())$

OR

Q6) a) Construct a PDA that accepts the language $L=\{a^n b^m a^n | m,n \geq 1\}$. **[8]**

Write ID for

i) $aabbaa$.

ii) $abbba$

b) Construct PDA for the following language **[8]**

$L=\{a^{2n} b^n | n \geq 1\}$

Q7) a) Design a TM which compares two positive integers m & n and produces output Gt if $m > n$; Lt if $m < n$; and Eq if $m = n$; **[12]**

Write simulation for the input

i) $m = 1, n = 2.$

ii) $m = n = 2.$

b) Write short note on UTM. **[6]**

OR

Q8) a) Construct TM for the language $L = \{a^n b^n c^n \mid n > 0\}$. **[10]**

b) Design a TM to find the value of $\log_2(n)$ where n is any binary number & a perfect power of 2. **[8]**

Q9) a) Prove that following are decidable languages. **[10]**

i) $A_{CFG} = \{\langle G, W\rangle \mid G \text{ is a CFG that generates string } W\}$.

ii) $E_{CFG} = \{\langle G, W\rangle \mid G \text{ is CFG } \& \, L(G) = \phi\}$.

b) Define the class P & Class NP problems with example. **[6]**

OR

Q10) a) Prove that **[8]**

$PCP = \{\langle P\rangle \mid P$ is an instance of the post correspondence problem with a match$\}$

is undecidable

b) Explain Turing Reduciability with example. **[8]**