Total No. of Questions :12]

SEAT No. :

P2964

[Total No. of Pages :4

[4958] - 205
T.E. (IT)
THEORY OF COMPUTATION
(2008 Course) (Semester - I)

Time : 3 Hours] ***[Max. Marks :100***

Instructions to the candidates:

1) ***Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 from the SECTION I.***
2) ***Solve Q.7 or Q.8, Q.9 or Q.10, Q.11 or Q.12 from the SECTION II.***
3) ***Answers to the two sections should be written in separate answer books.***
4) ***Neat diagrams must be drawn wherever necessary.***
5) ***Assume suitable data if necessary.***

SECTION - I

Q1) a) Design FA that rear strings made up of letters in the word CHARIOT and accept those string that contain 'CAT' as a substring. **[8]**

b) Define and explain: **[6]**

i) Language

ii) Kleene Closure

iii) Regular Expression

c) Describe English language for following RE : $(1 + 01 + 001)^*$. $(\in + 0 + 00)$. **[4]**

OR

Q2) a) Design FA to accepts 'L'. Who L = {"String in which a always appear tripled"} **[8]**

b) Give RE for following language over = {0, 1} **[6]**

i) Language of all strings that begin with "00" and end with "01"

ii) Language of all strings not containing substring 000.

c) Limitation of Finite State Machine : Explain in detail with an example. **[4]**

P.T.O.

Q3) a) Design a Mealy machine to check divisibility of binary number by 3. **[8]**

b) Construct DFA for regular expression $(00 + 11).(0 + 1)^*$ **[8]**

OR

Q4) a) Convert the following NFA into equivalent DFA. **[8]**

NFA = $(\{p,q,r,s\}, \{0, 1\}, \delta, p, \{s\})$

$Q \backslash \Sigma$	0	1
p	p,q	p
q	r	r
r	s	-
s	s	s

b) Construct NFA for the following regular expression. **[8]**

i) $a^+ b (bb)^*$

ii) $(a + b)^+ bab(a+b)^*$

Q5) a) Test whether the following grammars are ambiguous or not, if it is ambiguous then remove it. **[6]**

$S \rightarrow Ab, A \rightarrow a, B \rightarrow C \mid b, C \rightarrow D, D \rightarrow E, E \rightarrow a$

b) Convert the following grammar to Chomsky Normal Form (CNF). **[6]**

G= $(\{S\}, \{a, b\}, P, S)$.

S->ABA, A->aA, A->ε, B->bB, B->ε

c) Write a CFG grammar to generate the language $L = \{a^{2n} b^n \mid n>0\}$. **[4]**

OR

Q6) a) Show that CFLs are closed under Union, Concatenation and Kleene closure. **[6]**

b) Convert the given grammar CFG to GNF. **[6]**

S->AA | a, A->SS | b.

c) Construct CFG for language L = $\{a^m\ b^n\ c^p \mid p = m+n$ and m, $n > 1\}$. **[4]**

SECTION - II

Q7) a) State and prove pumping lemma theorem for regular language. **[6]**

b) Explain closure properties of regular expression. **[6]**

c) Let G = ({A0, A1}, {*a*, *b*}, P, A0)

Where P = {A0 -->aA1, A1-->bA1, A1-->a, A1-->bA0} Convert given grammar to equivalent Left linear grammar. **[6]**

OR

Q8) a) Explain Chomsky hierarchy with an example **[6]**

b) Let G = ({A, A}, {*a*, *b*}, P, A) where **[6]**

P = {A->*a*B

B->*b*B | *a* |*b*A}

Construct a FA equivalent to given grammar.

c) Construct a regular grammar G generating the regular set represented by

P = $a^{*}\ b\ (a^{*} + b^{*})^{*}$ **[6]**

Q9) a) Compare PDA with FSM and Construct PDA for S->0BB, B->0S |1S| 0. **[8]**

b) Design post machines following language: **[4]**

$L = \{a^n b^n \mid n>=1\}$.

c) Define acceptance by PDA **[4]**

i) By final state

ii) By empty stack

OR

Q10) a) Give the different between post machine with PDA. **[7]**

b) Obtain a PDA to accept the language $L = \{a^{2n} b^n \mid n > = 1\}$ by a final state **[9]**

Q11) a) Write short notes on: **[8]**

i) UTM

ii) Halting Problem of Turing Machine

b) Design a Turing machine to compute addition of two unary numbers. **[8]**

OR

Q12) a) Design a Turing machine which replaces occurrence of substring "111" by 101 over input = {0, 1}. **[8]**

b) Write short notes on: **[8]**

i) Types of Turing Machine

ii) Church Turing Hypotheses