Total No. of Questions :12]

SEAT No. :

P1676

[Total No. of Pages :4

[5058] - 165

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/FSM accept only those strings which ending with "abb" over input = {*a, b*} **[8]**

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

i) Alphabet and Strings.

ii) Formal Language.

iii) Regular expression.

c) Show that (0 +1)* = (0* 1*)* **[4]**

OR

Q2) a) Design a finite automata which perform addition of two Binary number. **[8]**

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

i) The language of all strings containing exactly two 0's.

ii) The language of all strings containing at least two 0's.

iii) The language of all strings not containing the substring 00.

c) Define Finite State Machine. Explain its properties and limitations. **[4]**

P.T.O.

Q3) a) Design a Mealy machine to check divisibility of decimal number by 4. **[8]**

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

OR

Q4) a) Construct a NFA and its equivalent DFA for accepting a language defined over input = {0, 1} such that each string has two consecutive zeros followed by 1. **[8]**

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

i) (00 +1)* (10)*

ii) 10 + (0 + 11) 0* 1

Q5) a) Consider the following grammar **[6]**

S->aB | bA,

A->a | aS | bAA,

B-> b | bS | aBB

Derive the string aaabbb using

i) Leftmost derivation.

ii) Rightmost derivation.

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

S->AACD

A->aAb | ε

C-> aC | a

D-> aDa | bDb | ε

c) Construct context free grammar corresponding to regular expression. **[4]**

(0 + 1) 1* (1 + (01)*)

OR

Q6) a) Write a CFG grammer to generate the language. **[6]**

i) $L = \{a^{2n} b^n | n>0\}$

ii) Palindrome strings of a' s and b's.

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

S-> ABA | AB |BA | AA| A| B

A-> aA |a, B-> bB|b

c) Define ambiguous grammar. Is the following grammar ambiguous? **[4]**

S-> aAS|a, A->SbA | SS | ba

SECTION - II

Q7) a) Prove that $L = \{a^n b^n | n>= 1|$ is not regular using pumping lemma theorem. **[6]**

b) State and Explain closure properties of regular expression with example. **[6]**

c) Let G = ({A0, A1}, {a, b}, P, A0) **[6]**

Where P = {A0-> A1a, A1-> A1b, A1->a, A1->A0b}

Convert given grammar Left linear grammar to equivalent Right linear grammar.

OR

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

b) Let G = ({S, B, A, C}, {0, 1}, P, S) where **[6]**

P = {S-> B1 |A0 |C0

B->B1 | 1

A-> A1 | B1 | C0 | 0

C-> A0

}

Construct a FA equivalent to given grammar.

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

P = 0* 1 (0 + 1)* **[6]**

Q9) a) Construct PDA which accepts the language generated by the following CFG for arithmetic operations S-> S+S |S*S| 4 **[8]**

b) Define post machines. Compare PDA and post machine. **[4]**

c) Write a short note on closure properties of CFLs. **[4]**

OR

Q10)a) Construct equivalent CFG for given PDA. **[8]**

$M = (\{q_0, q_1\}, \{0, 1\}, \{z_0, x\}, \delta, q_0, z_0, \Phi)$

$\delta(q_0, 1, z_0) = (q_0, xz_0)$

$\delta(q_0, 1, x) = (q_0, xx)$

$\delta(q_0, 0, x) = (q_1, x)$

$\delta(q_0, \wedge, z_0) = (q_0, \wedge)$

$\delta(q_1, 1, x) = (q_1, \wedge)$

$\delta(q_1, 0, z_0) = (q_0, z_0)$

b) Design PDA to accept the language $L = \{a^n b^{2n} \mid n > 1\}$ by a final state. **[8]**

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

i) Nondeterministic Turing Machine.

ii) Halting Problem of Turing Machine.

b) Design a Turing machine to compute 2's complement of given binary number. **[8]**

ORORR

Q12)a) Design a Turing machine to add two unary numbers. **[8]**

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

i) Limitations of TM.

ii) Universal Turing Machine.