Total No. of Questions : 12]

SEAT No.:

P1145

[Total No. of Pages : 4

May - June 2012

[4163]-352
T.E. (Information Technology)
THEORY OF COMPUTATION
(2008 Pattern) (Sem. - I)

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

Instructions to the candidates:

1) *Answer Question 1 or 2, 3 or 4, and 5 or 6 from section-I and Question 7 or 8, 9 or 10, and 11 or 12 from section-II.*
2) *Answers to the two sections should be written in separate answer books.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Figures to the right indicate full marks.*
5) *Assume suitable data if necessary.*

SECTION - I

Q1) a) Define and explain : **[8]**

i) Regular expression.
ii) Alphabet.
iii) Finite Automata.
iv) Relation and its properties.

b) Design a Finite State Machine for divisibility by 3 tester of given decimal number. **[8]**

OR

Q2) a) Construct NFA from the following regular expression. **[8]**

i) $(ab + ba)^+$.
ii) $(a + b)^* ab$.

b) Design a FA that reads strings made up of letters in the word "CHARIOT" that recognize those string that contain the word 'CAT' as a substring. **[8]**

Q3) a) Define FSM equivalence? Explain Moore's algorithm with the help of example. **[8]**

P.T.O.

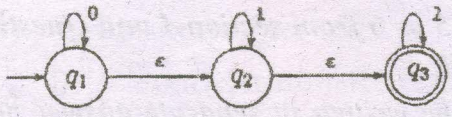
b) Consider the following ε-NFA. [8]

	ε	a	b	c
→p	ϕ	{p}	{q}	{r}
q	{p}	{q}	{r}	ϕ
r*	{q}	{r}	ϕ	{p}

i) Compute the ε-closure of each state.
ii) Convert the automaton to DFA.

OR

Q4) a) Convert NFA with ε-moves to equivalent NFA without ε-moves. [8]



b) Construct DFA equivalent to NFA. [8]

({p, q, r, s, t}, {0, 1}, δ, p, {s, t}) where

δ =

	0	1
→p	{p, q}	{p}
q	{r, s}	{t}
r	{p, r}	{t}
s*	ϕ	ϕ
t*	ϕ	ϕ

Q5) a) Define and explain Grammar. [2]

b) Let G be the grammar. [8]

S → aB | bA
A → a | aS | bAA
B → b | bS | aBB

for string aaabba bbba

i) Find leftmost and rightmost derivation.
ii) Check the grammar is ambiguous or not?

c) Convert the following grammar to Chomsky Normal Form (CNF). [8]

S → ABA
A → aA | ε
B → bB | ε

OR

Q6) a) Convert the following grammar to GNF. [9]

$G = (\{A1, A2, A3\}, \{a, b\}, P, A1)$

$P = \{A1 \rightarrow A2A3$

$A2 \rightarrow A3A1 \mid b$

$A3 \rightarrow A1A2 \mid a\}$

b) Write a note on : [9]

i) Removal of useless symbols.

ii) Removal of unit productions.

iii) Removal of ε productions.

SECTION - II

Q7) a) By using Pumping Lemma, prove that following language $L = \{1^p \mid p$ is a prime number$\}$ is not a context-free language. [8]

b) Give the left linear grammar for the regular expression $(10)^* 1$. [4]

c) Give the right linear grammar for the regular expression $0^*1\ (0 + 1)^*$. [4]

OR

Q8) a) State and prove Pumping lemma theorem for Context-Free Languages. [8]

b) Convert the following right linear grammar to left linear grammar - [4]

$S \rightarrow bB$

$B \rightarrow bC$

$B \rightarrow aB$

$B \rightarrow b$

$C \rightarrow a$

c) Construct finite automaton for following left linear grammar - [4]

$S \rightarrow X0 \mid Y1$

$X \rightarrow Y1$

$X \rightarrow Y0 \mid 1$

Q9) a) Obtain a PDA to accept a string of balanced parentheses. The parentheses to be considered are (,), [,]. [8]

b) For the grammar - [8]

$S \rightarrow aABB \mid aAA$

$A \rightarrow aBB \mid a$

$B \rightarrow bBB \mid A$

$C \rightarrow a$

Obtain the corresponding PDA.

OR

Q10) a) Obtain a PDA to accept the language $L = \{a^n b^{2n} \mid n \geq 1\}$. **[8]**

b) Explain with example DPDA and NDPDA. **[8]**

Q11) a) Construct a Turing Machine to accept the following language $L = \{0^n 1^n 2^n \mid n \geq 1\}$. **[10]**

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

i) Multidimensional TM.

ii) Halting problem of TM.

OR

Q12) a) Design a Turing Machine to multiply two unary numbers. **[10]**

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

i) Nondeterministic TM.

ii) Acceptance of language by TM.