NOV - DEC - 2011

[4063] – 352

T.E. (Information Technology) (Semester – I) Examination, 2011
THEORY OF COMPUTATION
(2008 Pattern) (New)

Time : 3 Hours | Max. Marks : 100

Instructions:
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

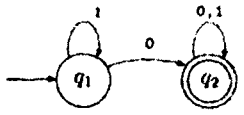
1. a) Define and explain : **8**
   i) Language
   ii) Cartesian Product
   iii) Regular Expression
   iv) Kleene Closure.

   b) Design a Finite State Machine for divisibility by 5 tester of a given decimal number. **8**

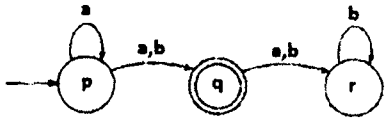
OR

2. a) Construct NFA from the following regular expressions : **8**
   i) 0*1*2*
   ii) (00 + 1)* (10)*.

   b) Obtain regular expression for the following FA. **8**



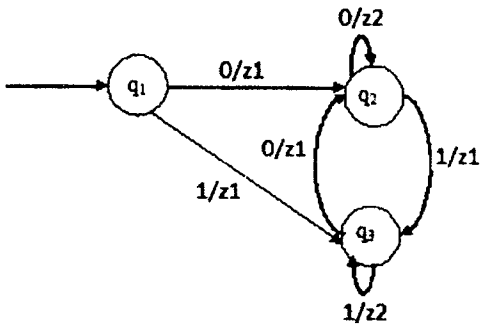
3. a) Convert the following NFA to its equivalent DFA. **8**



P.T.O.

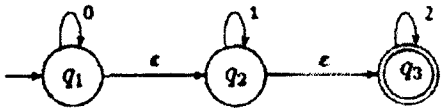
b) Design a Moore Machine for checking divisibility by 3 of a given decimal number (residue of 3). **4**

c) Consider the following Mealy machine, construct a Moore machine equivalent to it. **4**



OR

4. a) Convert the following NFA-ε to its equivalent DFA. **8**



b) Construct the NFA for the language of all strings that begin and end with same symbol over the alphabet $\Sigma = \{0, 1\}$. **4**

c) Design a DFA which accepts the odd number 1's and any number of 0's over $\Sigma = \{0, 1\}$. **4**

5. a) Show that the following grammar is ambiguous **6**

$S \rightarrow aSbS$

$S \rightarrow bSaS$

$S \rightarrow \varepsilon$.

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

G = ({S}, {a, b}, P, S)

P = {S → aSa | bSb | a | b | aa | bb}

c) Obtain a grammar to generate the language **6**

$L = \{a^{n+2} b^n \mid n \geq 0 \text{ and } m > n\}$

OR

6. a) Obtain the unambiguous grammar for the following grammar **6**

$E \rightarrow E + E \mid E - E$

$E \rightarrow E * E \mid E / E$

$E \rightarrow (E) \mid I$

$I \rightarrow a \mid b \mid c$

b) Consider the following grammar **4**

$S \rightarrow aAS \mid a$

$A \rightarrow SbA \mid SS \mid ba$

Derive the string aabbaa using

i) Leftmost derivation

ii) Rightmost derivation.

c) Convert the following grammar to GNF **8**

$G = (\{A_1, A_2, A_3\}, \{a, b\}, P, A_1)$

$P = \{A_1 \rightarrow A_2A_3$

$A_2 \rightarrow A_3A_1 \mid b$

$A_3 \rightarrow A_1A_2 \mid a\}$

SECTION – II

7. a) Convert the following right linear grammar to left linear grammar **4**

$S \rightarrow 0A$

$A \rightarrow 1A$

$A \rightarrow \varepsilon$

b) Obtain a grammar to generate a string consisting of any number of a's and b's with at least one a. **4**

c) State and prove Pumping lemma theorem for Context-Free Languages. **8**

OR

8. a) Show that CFLs are closed under Union, Concatenation and Kleene closure. **8**

b) By using Pumping Lemma, prove that following language **8**

$L = \{ww \mid w \in \{a, b\}^*\}$ is not a context-free language.

9. a) Obtain a PDA to accept the language **8**

$L = \{a^n b^n \mid n \geq 1\}$ by a final state.

b) Obtain PDA for the following grammar **8**

$S \rightarrow aABC$

$A \rightarrow aB \mid a$

$B \rightarrow bA \mid b$

$C \rightarrow a.$

OR

10. a) Construct PDA which accepts language consisting of even length palindrome of strings of a's and b's. **8**

b) Define post machines and explain its elements. **4**

c) Define acceptance by PDA **4**

i) By final state

ii) By empty stack.

11. a) Construct a Turing Machine to accept the following language **8**

$L = \{x \in \{a, b\}^* \mid x \text{ contains the substring aba}\}$

b) Write short notes on : **10**

i) Limitation of Turing Machine

ii) Halting Problem of Turing Machine.

OR

12. a) Design a Turing Machine to add two unary numbers. **8**

b) Write short notes on : **10**

i) Universal Turing Machine

ii) Multi-tape Turing Machine.