May - June - 2011

[3963] – 362

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

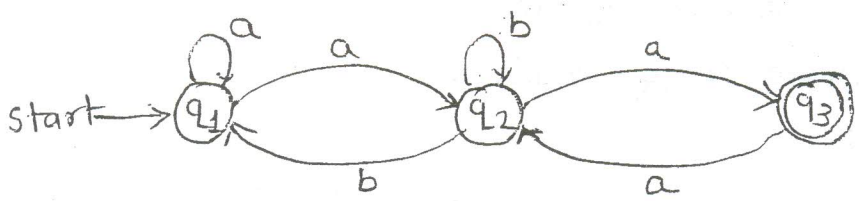
Time : 3 Hours

Max. Marks : 100

Instructions : *1) Answer **any 3** questions from **each** Section.*
*2) Answers to the **two** Sections should be written in **separate** books.*
*3) **Neat** diagrams must be drawn **wherever** necessary.*
*4) Black figures to the **right** indicate **full** marks.*
*5) Assume **suitable** data, **if necessary**.*

SECTION – I

1. a) Consider the transition diagram given below. Prove that the strings recognized are : (a + a (b + a a)*b)*a (b + a a)*a. **6**



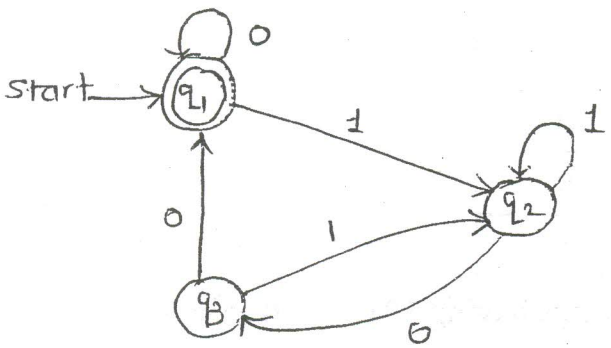
b) State and explain Pumping Lemma for regular sets. **6**

c) Construct NFA for the following regular expression. **6**

$(0 + (0 + 1)^*)^+$

OR

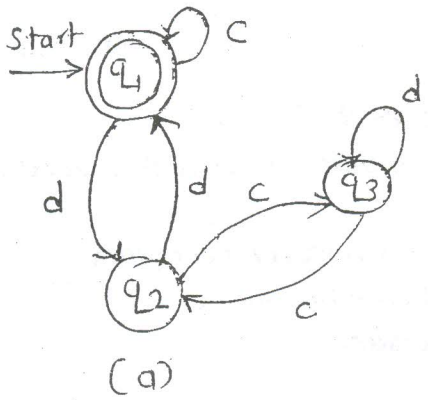
2. a) Construct a regular expression corresponding to the state diagram given below : **6**



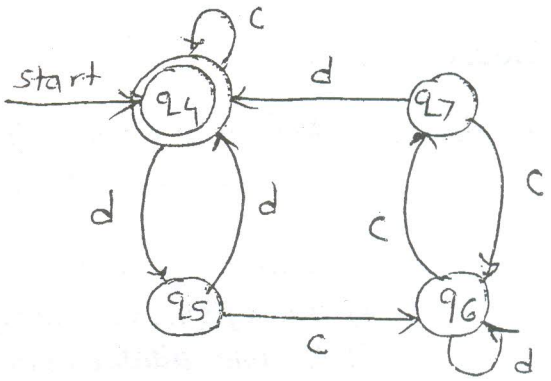
P.T.O.

b) Show that the set $L = \{a^{i^2} \mid_{i \geq 1}\}$ is not regular. **6**

c) Consider the DFAs shown below. Are they equivalent ? **6**



(a)



(b)

3. a) Design a finite automata which accepts even number of 0's and odd number of 1's. **6**

b) Convert the following NFA into equivalent DFA **6**

$M = (\{q_0, q_1\}, \{0,1\}, \delta, q_0, \{q_1\})$ where

$\delta(q_0, 0) = \{q_0, q_1\}, \delta(q_0, 1) = \{q_1\}, \delta(q_0, 0) = \phi$

$\delta(q_1, 1) = \{q_0, q_1\}$

c) Design a Moore machine to generate 1's compliment of the given binary number. **4**

OR

4. a) State with brief explanation FSM properties and limitations. **6**

b) Convert the following Moore machine to Mealy machine. **6**

State	Input		Output
	a	b	
q_0	q_1	q_3	1
q_1	q_3	q_1	0
q_2	q_0	q_3	0
q_3	q_3	q_2	1

c) Design a FSM to concept those strings having 101 or 110 as substring. **4**

5. a) Let $G = (\{s\}, \{a, b\}, \{s \to asb, s \to \varepsilon\}, s)$ **4**
Find the language L(G).

b) Define ambiguous grammar.

Consider the following CFG

$E \to E + E$

$E \to E * E$

$E \to E \wedge E$

$E \to id$

Write an unambiuous CFG equivalent to the above grammar. **8**

c) Write a CFG to represent a language defined by the regular expression a^*b^*. **4**

OR

6. a) Construct a grammar for L which consists of strings over $\{0, 1\}^*$ with at least one occurrence of '000'. **4**

b) Find a grammar in Chomsky normal form equivalent to $S \to aAbB$, $A \to aA/a$, $B \to bB/b$. **6**

c) Convert the given right-linear grammar into its equivalent left linear grammar. **6**

$S \to bB$

$B \to bC$

$B \to aB$

$C \to a$

$B \to a$

SECTION – II

7. a) Explain properties of regular expression. **6**

b) Let $G = (\{A_0, A_1\}, \{a, b\}, P, A_0)$ where

$P = \{A_0 \to aA_1$
$A_1 \to bA_1$
$A_1 \to a$
$A_1 \to bA_0$
$\}$

Construct a FA equivalent to G. **6**

c) Convert the following CFG to CNF **6**

$S \to aSa \mid bSb \mid a \mid b \mid aa \mid bb$

OR

8. a) Explain Chomsky Hierarchy. **6**

   b) Construct a regular grammar G generating the regular set represented by $P = a^*b(a+b)^*$. **6**

   c) If a regular grammar G is given by $S \rightarrow aS \mid a$, find M accepting L(G). **6**

9. a) Construct a PDA which accepts the language generated by the following CFG for arithmetic expressions **8**

   $S \rightarrow S + S$
   $S \rightarrow S * S$
   $S \rightarrow 8$

   b) Construct a regular grammar G generating the regular set represented by $P = a * b(a+b)^*$. **8**

OR

10. a) Compare PDA with FSM. **4**

    b) Show that post machine has more power than PDA. **4**

    c) Design a PM to check well formed parenthesis. **8**

11. a) Design a Turing machine to subtract two unary numbers, the original numbers need not be retained. **8**

    b) Write a short note on universal Turing machine. **8**

OR

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

    b) Explain limitations of Turing machine with reference to the halting problem. **8**
