Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(CSE/IT)NEW/SEM-4/CS-402/2012

2012
FORMAL LANGUAGE & AUTOMATA THEORY

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

i) The basic limitation of FSM is that

a) it can't remember arbitrary large amount of information

b) it sometimes recognize grammar that is not regular

c) it sometimes fails to recognize grammar that is regular

d) all of these.

ii) Choose the correct statements :

a) Moore & Mealy machine are FSM with output capabilities

b) Any given Moore machine has an equivalent Mealy machine

c) Any given Mealy machine has an equivalent Moore machine

d) Moore machine is not an FSM.

iii) The intersection of CFL & regular language

a) need not be regular b) need not be CF

c) is always regular d) none of these.

iv) Palindromes can't be recognized by any FSM because

a) an FSM can't be remember arbitrary large amount of information

b) an FSM can't deterministically fix the mid point

c) FSM can't find whether 2nd half of the string machines the 1st half or not

d) None of these.

v) Can a DFA simulate NFA ?

a) no b) yes

c) some times d) depends on DFA.

vi) $(P + Q)^*$ = ?

a) $(P^* + Q^*)$ b) $P^* + Q^*$

c) $(P^* Q^*)^*$ d) both (a) and (c).

vii) What is the RE for the language set strings with atleast one 1, one 2 and one 3 ?

a) 1 + 2 + 3 b) $11^* 22^* 33^*$

c) $1^* 2^* 3$ d) both (a) and (b).

viii) Which of the following sets is regular ?

a) $\{ a^i : i = n^2, n >= 1 \}$

b) $\{ a^p : p \text{ is prime} \}$

c) $\{ ww : w \text{ is in } (a, b) + \}$

d) $\{ a^{2n} : n >= 1 \}$.

ix) The regular expression representing the set of all strings over $\{ x, y \}$ ending with XX beginning with Y is

a) $XX(X + Y)^* Y$ b) $YY(X + Y)^* X$

c) $Y(X + Y)^* XX$ d) $Y(XY)^* XX$.

x) Regular expression (a/b)(a/b) denotes the set

a) $\{ a, b, ab, aa \}$ b) $\{ a, b, ba, bb \}$

c) both (a) and (b) d) none of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Show that $L = \{ O^n 1^n | n >= 1 \}$ is not regular.

3. Write the CFG for the following language

   $L = \{ 0^i 1^j 2^k | I = j j = k \}$

4. Design a PDA which accepts the language

   $L = \{ w \in (a,b)^* | w$ has equal no. of a & $b \}$.

5. a) Give DFA which reads strings from {a,b} and with aaa. 3

   b) Construct a DFA equivalent to M = { $\{q_0, q, \}$, $\{0, 1\}$, δq_o, $\{q_0\}\}$, δ is given by the state table.

State /	0	1
q_0	q_0	q_1
q1	q_1	q_0, q1

2

6. Find a GNF grammar equivalent to the following CFG :

   $A_1 \rightarrow A_2 A_3$

   $A_2 \rightarrow A_3 A_1 | b$

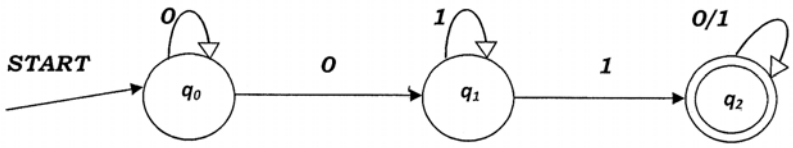
   $A_3 \rightarrow A_1 A_2 | a$

GROUP – C

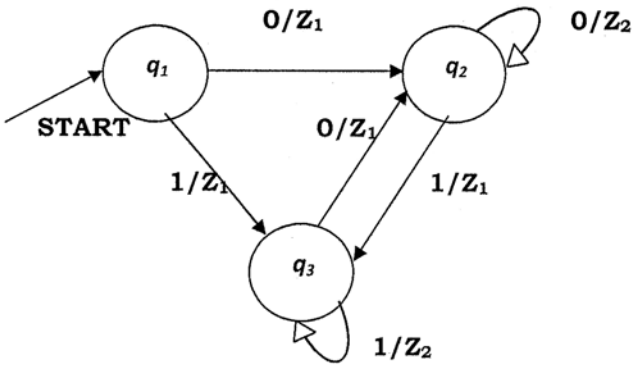
(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) Construct a *DFA* diagram to the *NFA* given below. 6



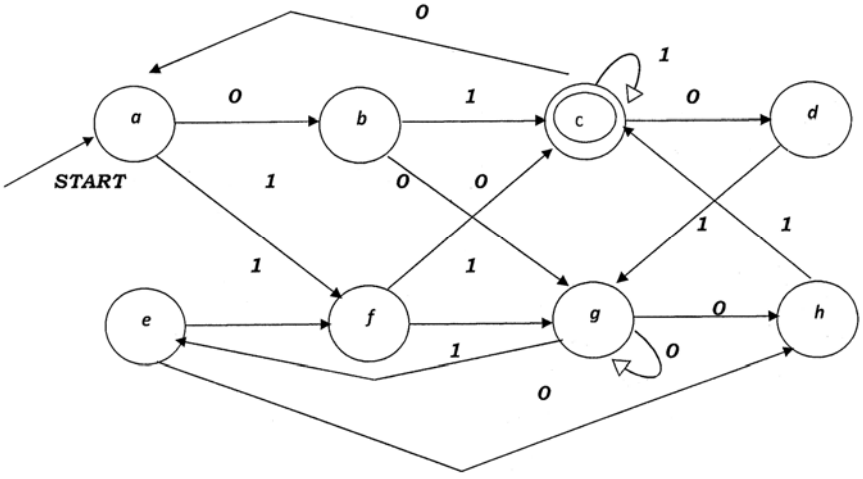
b) Convert Mealy Machine to Moore Machine. 6



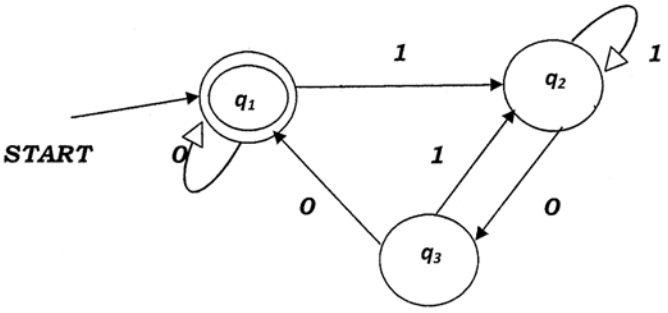
c) What are Kleene Closure and Positive Closure ? Give example for both. 2 + 1

8. a) What are distinguishable and Indistinguishable state ? 3

b) Use Myhill Nerode Theorem to minimize the following finite automata. 12



9. a) Give the Regular Expression for the *DFA* using arden Theorem. 5



b) What is Griebach Normal Form (*GNF*) for Context Free grammar ?

Convert the following grammar into *GNF*

$S \rightarrow ABb/a$

$A \rightarrow aaA/B$

$B \rightarrow bAb$ 1 + 4

c) Using Pumping Lemma show that $L = \{a^n b^n : n >= 0\}$ is not regular. 5

10. a) Construct a *NFA* with ε or λ transition for

$r = (11 + 0)^*(00 + 1)^*$ 5

b) What is PDA ? 5

c) Construct PDA for $L = \{ww^R : w \text{ belongs to } (0, 1)^*\}$ 5

11.

PS	**NS, Z**		
	I_1	I_2	I_3
A	*C,O*	*E,*1	…….
B	*C,O*	*E,…*	…….
C	*B,…*	*C,O*	*A,…*
D	*B,O*	*C,…*	*E,…*
E	……	*E*	*A,…*

For the incompletely specified machine shown above find the minimum state reduced machine containing the original one. 8

PS	***NS,Z***	
	$x = 0$	$x = 1$
A	*B*, 1	*H*, 1
B	*F*, 1	*D*, 1
C	*D*, 0	*E*, 1
D	*C*, 0	*F*, 1
E	*D*, 1	*C*, 1
F	*C*, 1	*C*, 1
G	*C*, 1	*D*, 1
H	*C*, 0	*A*, 1

Using this table

a) Find the equivalence partition. 3

b) Find the standard form of the corresponding reduced machine. 3

c) What is the minimum length sequence that distinguishes state *A* from state *B* ? 1