



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 × 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) $\{ a^i : i = n^2, n \geq 1 \}$
- b) $\{ a^p : p \text{ is prime} \}$
- c) $\{ ww : w \text{ is in } (a, b)^+ \}$
- d) $\{ a^{2n} : n \geq 1 \}$.
- 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 $L = \{ 0^n 1^n \mid n \geq 1 \}$ is not regular.
3. Write the CFG for the following language
 $L = \{ 0^i 1^j 2^k \mid i = j = k \}$
4. Design a PDA which accepts the language
 $L = \{ w \in (a,b)^* \mid w \text{ has equal no. of } a \text{ \& } b \}$.
5. a) Give DFA which reads strings from {a,b} and with aaa. 3
 b) Construct a DFA equivalent to $M = \{ \{q_0, q_1\}, \{0, 1\}, \delta_{q_0}, \{q_0\} \}$, δ is given by the state table.

State /	0	1
q ₀	q ₀	q ₁
q ₁	q ₁	q ₀ , q ₁

2

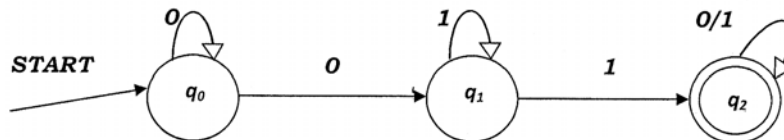
6. Find a GNF grammar equivalent to the following CFG :
 $A_1 \rightarrow A_2 A_3$
 $A_2 \rightarrow A_3 A_1 \mid b$
 $A_3 \rightarrow A_1 A_2 \mid a$

GROUP - C

(Long Answer Type Questions)

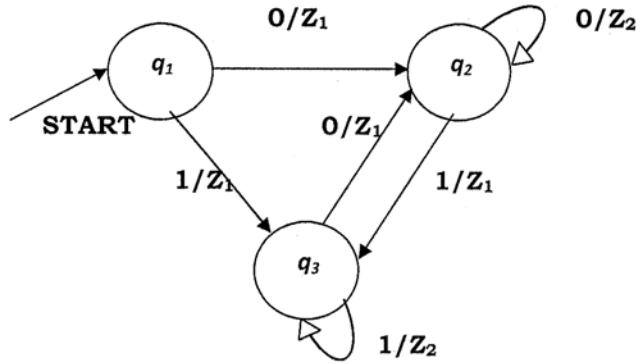
Answer any *three* of the following. 3 × 15 = 45

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





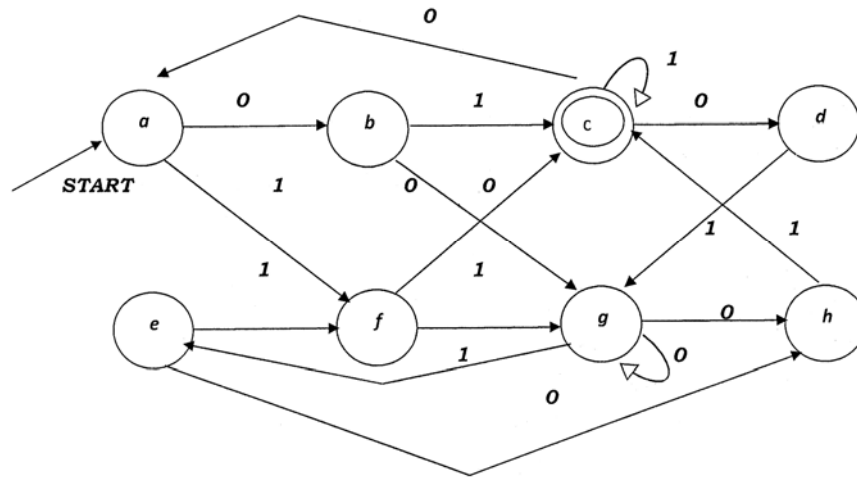
b) Convert Mealy Machine to Moore Machine. 6



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

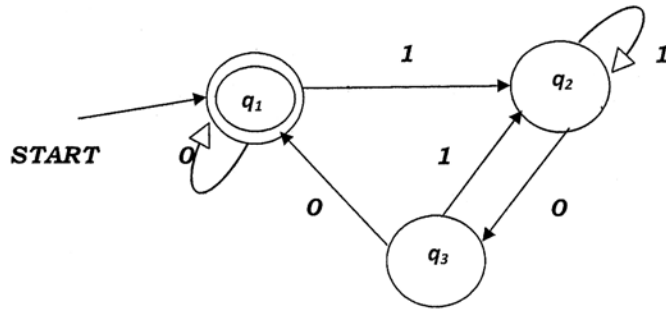
8. a) What are distinguishable and Indistinguishable state ? 3

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

$$S \rightarrow ABb/a$$

$$A \rightarrow aaA/B$$

$$B \rightarrow bAb \quad 1 + 4$$

- c) Using Pumping Lemma show that $L = \{a^n b^n : n \geq 0\}$ 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