

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 Question)

1. Choose the correct alternatives for the following: 10 x 1 = 10
 - i) The basic limitation of FSM is that
 - a) it cannot 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 cannot be recognized by any FSM because
- a) an FSM cannot remember arbitrary large amount of information
 - b) an FSM cannot deterministically fix the mid point
 - c) FSM cannot find whether 2nd half of the string matches the 1st half or not
 - d) None of these.
- v) Can a DFA simulate NFA?
- a) no b) yes
 - c) sometimes 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) $\{a^{2^n} : n \geq 1\}$

- 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 x 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
 $L = \{0^i 1^j 2^k \mid i = j, j = k\}$
4. Design a PDA which accepts the language
 $L = \{\omega \in (a, b)^* \mid \omega \text{ has equal no. of } a \text{ \& } b\}.$
5. a) Give DFA which reads strings from $\{a, b\}$ and with aaa .

3

- b) Construct a DFA equivalent to
 $M = \{\{q_0, q\}, \{0, 1\}, \delta q_0, \{q_0\}\}, \delta$ 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:

$$A_1 \rightarrow A_2 A_3$$

$$A_2 \rightarrow A_3 A_1 \mid b$$

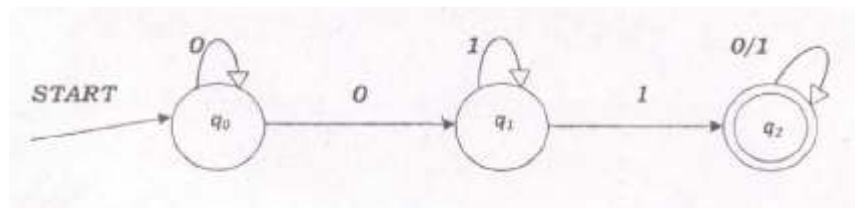
$$A_3 \rightarrow A_1 A_2 \mid a$$

GROUP – C

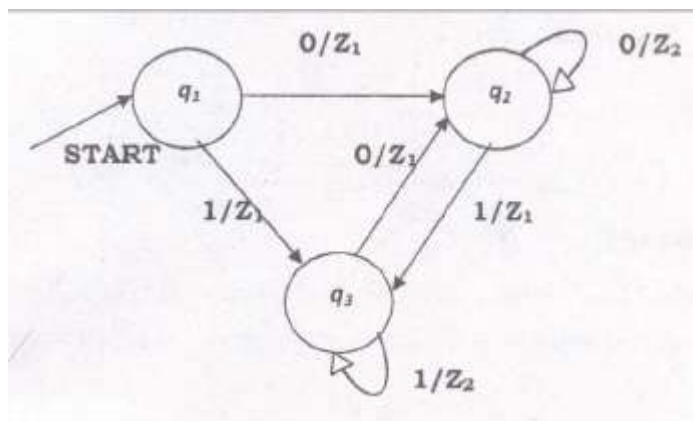
(Long Answer Type Questions)

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

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



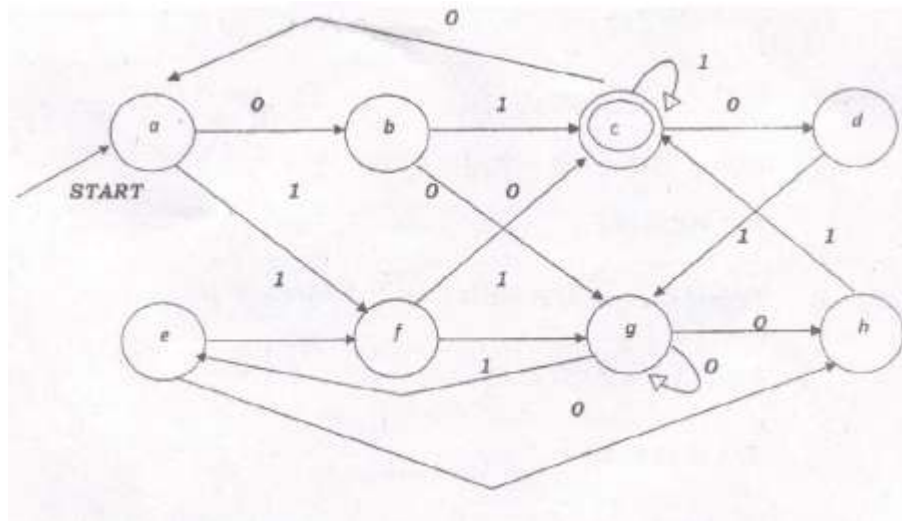
- b) Convert Mealy Machine to Moore Machine.



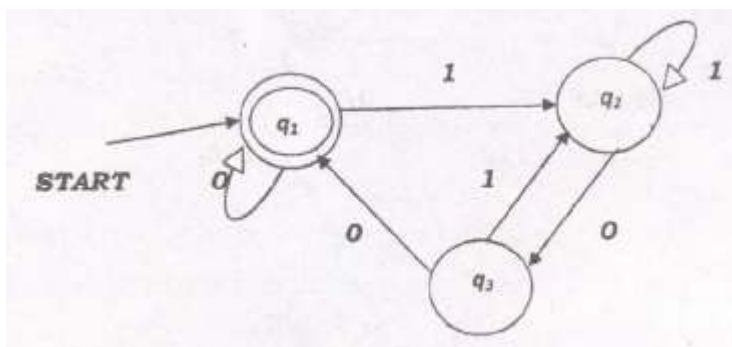
- c) What are Kleene Closure and Positive Closure? Give example for both. 2 + 1

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

- b) Use Myhill Nerode Theorem to minimize the following finite automata. 6



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



- b) What is Griebach Normal Form (CNF) 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 $L = \{a^n b^n : n \geq 0\}$ 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 $L = \{\omega\omega^R : \omega \text{ belongs to } (0,1)^*\}$ 5

11.

PS	NS, Z		
	I_1	I_2	I_3
A	$C, 0$	$E, 1$
B	$C, 0$	E, \dots
C	B, \dots	$C, 0$	A, \dots
D	$B, 0$	C, \dots	E, \dots
E	E	A, \dots

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

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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	$C, 1$	$C, 0$
G	$C, 1$	$D, 1$
H	$C, 0$	$A, 1$

Using this table

- a) Fine the equivalent 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

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