



Name :
Roll No. :
Invigilator's Signature :

CS / B.TECH (CSE) / SEM-4 / CS-401 / 2011

2011

FORMAL LANGUAGE AND 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) Moore machine output depends on
 - a) input
 - b) input and present state
 - c) present state
 - d) none of these.
 - ii) FSM can recognize
 - a) a grammar dependent on characteristic of FSM
 - b) on CFG
 - c) any unambiguous grammar
 - d) only regular grammar.

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iii) DFA has a transition function

- a) $Q \times \Sigma$ to Q b) $Q \times \Sigma$ to 2^Q
 c) both (a) and (b) d) none of these.

iv) The class of CFG is not closed under

- a) concatenation
 b) intersection
 c) union
 d) repeated concatenation.

v) Consider the CFG

$$\begin{aligned} X &\rightarrow XY \\ X &\rightarrow zX / bX / a \\ Y &\rightarrow Ya / Yb / b \end{aligned}$$

Any string of terminals, which can be generated by the CFG

- a) has at least one b
 b) ends with a
 c) has no consecutive a 's or b 's
 d) has at least 2 a 's.
- vi) A grammar that produces more than one parse tree for some sentence is said to be
- a) contiguous b) ambiguous
 c) unambiguous d) regular.

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regular grammar

The logo of Utech (University of Technology) is a shield-shaped emblem. At the top, it reads 'WEST BENGAL UNIVERSITY OF TECHNOLOGY'. In the center, there is a stylized gear or circular design with the word 'Utech' written across it. Below the shield, a banner contains the motto 'In Pursuit Of Knowledge And Excellence'.

- $$S \rightarrow aS / bS / a / b$$

a) $a + b$

b) $(a + b)^*$

c) $(a + b)(a + b)^*$

d) $(aa + bb)a^*b^*$.

- a) Q
- b) $Q - 1$
- c) $2Q - 1$
- d) 2^Q .

- a) $(a + b)^{+}$ b) $(a + b)(a + b)^{*}$
c) $(a + b)^{*}(a + b)$ d) all of these.

- a read head
- a memory in the form of stack
- a set of states
- all of these.

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**GROUP – B****(Short Answer Type Questions)**Answer any *three* of the following. $3 \times 5 = 15$

2. Convert the following Context-free grammar into an equivalent grammar in CNF

$$S \rightarrow 1A/0B$$

$$A \rightarrow 1AA/0S/0$$

$$B \rightarrow 0BB/1S/1$$

3. Is the following machine information lossless ? If yes, find the order of losslessness.

PS	NS, z	
	X = 0	X = 1
A	A, 0	B, 0
B	C, 0	D, 0
C	D, 1	C, 1
D	B, 1	A, 1

4. Let G be the grammar

$$S \rightarrow aB/ba, A \rightarrow a/aS/bAA, B \rightarrow b/bS/aBB$$

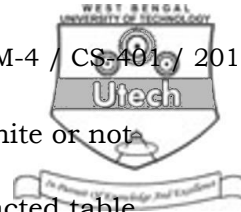
For the string *aaabbabbba*, find

- leftmost derivation
 - rightmost derivation
 - parse tree.
5. Construct a Turing machine that accepts all strings over $\{0, 1\}$ with an even number 0's and even number of 1's.

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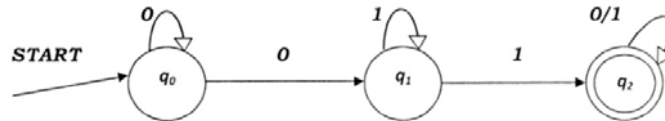


6. Test whether the following machine is definite or not.
- by using synchronizing tree
 - by using repeated derivation of contracted table
 - if the machine is definite, what is the order of definiteness ? Justify.

Present State	Next State	
	$a = 0$	$a = 1$
A	A	B
B	C	B
C	A	D
D	C	B

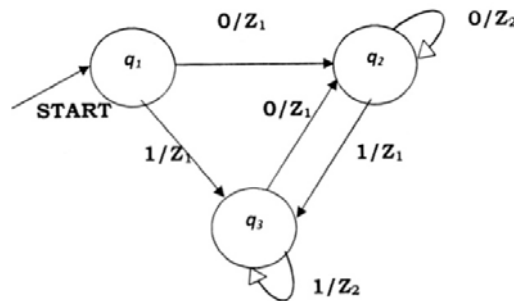
GROUP – C**(Long Answer Type Questions)**Answer any *three* of the following. $3 \times 15 = 45$

7. a) Construct a DFA diagram from the NFA given below :



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- b) Convert Mealy Machine to Moore Machine.



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

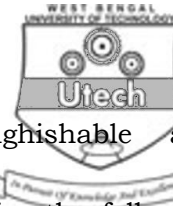
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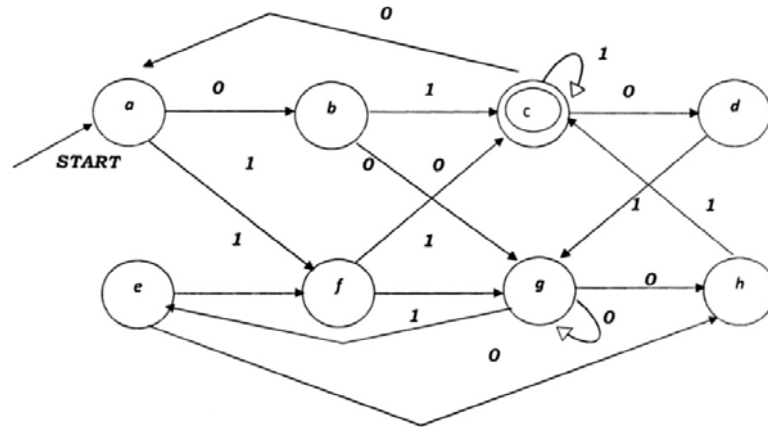
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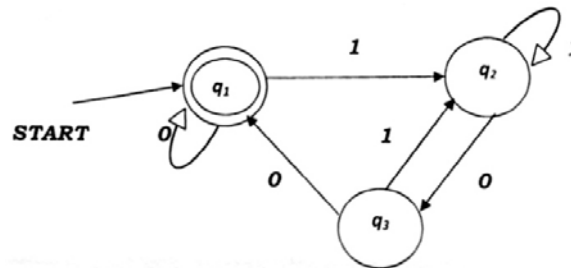
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8. a) What do you mean by Disginghishable and Indistinguishable state ? 3
- b) Use Myhill Nerode Theorem to minimize the following finite automata : 12



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



- b) What is Griebach Normal Form (GNF) for Context Free grammar ? 1 + 4

Convert the following grammar into GNF

$$S \rightarrow ABb/a$$

$$A \rightarrow aaA/B$$

$$B \rightarrow bAb$$

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

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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. a) What do you mean by k-equivalent states ? 3
- b) Draw the Merger graph, Merger table, Compatibility graph and then minimize the following : 12

Present State	Next State, o/p			
	$i/p = 0$	$i/p = 1$	$i/p = 2$	$i/p = 3$
A	—	C, 1	E, 1	B, 1
B	E, 0	—	—	—
C	F, 0	F, 1	—	—
D	—	—	B, 1	—
E	—	F, 0	A, 0	D, 1
F	C, 0	—	B, 0	C, 1

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