



PAPER ID : 1071

TCS-403

Printed Pages : 4

Paper ID and Roll No. to be filled in your Answer Book

Roll No.

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B. Tech.

(SEM. IV) EXAMINATION, 2011

THEORY OF AUTOMATA

Time : 3 Hours]

[Total Marks :

*Note : Attempt all questions.
All questions carry equal marks.*

I Answer any **four** of following :

- (i) Draw a block diagram to define automata. Also explain deterministic and non-deterministic automata.
- (ii) What do you understand by star closure and positive closure ? Explain both by giving an example.
- (iii) Define functions and relations. Explain the difference between these two by giving an example.
- (iv) What is the difference between original and extended Chomsky hierarchies. Also show the relation in L_{LIN} , L_{REG} , L_{DCF} and L_{CF} using a suitable diagram. Here L_{LIN} , L_{REG} , L_{DCF} and L_{CF} denotes linear language, regular language deterministic context free language, and context free language respectively.
- (v) Define finite automata and show the block diagram of this. Also, explain 'Indirect Transition Function'.
- (vi) What do you know about complement and reverse of a language ? Explain both of these by giving suitable examples.

2 Answer any **four** of the following :

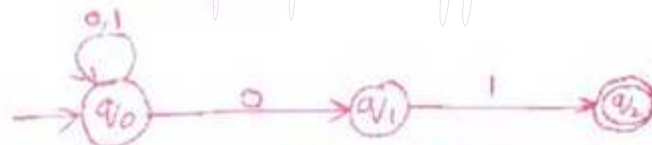
(i) Construct a DFA equivalent to

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

δ is given by its state table, as below :

State / Σ	0	1
$\rightarrow q_0$	q_0	q_1
q_1	q_1	q_0, q_1

(ii) For the following NFA, find the states of NFA during processing of input sequence 00101. Also find an input sequence not accepted by this transition system.



(iii) What do you understand by "Finite automata with output function" ? What is the output function for Mealy and Moore machine ? Also define these 2 machines.

(iv) Explain the applications of finite automata in brief.

(v) Consider the Mealy machine described by the following transition table. Construct a Moore machine which is equivalent to the Mealy machine :

Present state	Next state			
	input a=0		input a=1	
	state	output	state	output
$\rightarrow q_1$	q_3	0	q_2	0
q_2	q_1	1	q_4	0
q_3	q_2	1	q_1	1
q_4	q_4	1	q_3	0

- (vi) For the finite state machine M given in following table, find out the strings among the following strings which are accepted by M.

- (a) 101101
(b) 11111
(c) 000000

States	Inputs	
	0	1
$\rightarrow q_0$	q_2	q_1
q_1	q_3	q_0
q_2	q_0	q_3
q_3	q_1	q_2

3 Attempt any two of the following :

- (i) Explain the pumping Lemma for CFL in brief.
Using Pumping Lemma, show that the following languages are not CFL :

(a) $L = \{ww : w \in \{a, b\}^*\}$

(b) $L = \{a^n : n \geq 0\}$

(ii) Prove that -

(a) $\lambda + 1^*(011)^*1^*(011)^* = (1+011)^*$

(b) $(1+00^*1) + (1+00^*1)(0+10^*1)^*(0+10^*1)$
 $= 0^*1(0+10^*1)^*$

(c) G is ambiguous, if G is the grammar
 $S \rightarrow Sbs \mid a$

(d) G is ambiguous, if G is the grammar
 $S \rightarrow aSb \mid SS \mid \lambda$

- (iii) Explain following :
- Context-free and context-sensitive grammar
 - Regular grammar
 - Regular language
 - Regular expression.
4. Attempt any two of the following :
- Define Pushdown Automaton (PDA) and its types. Draw the model of PDA and explain its working. Is there any difference between FA and PDA, explain it.
 - Construct a pda A accepting the set of all strings over $\{a, b\}$ with equal number of a's and b's.
 - Construct a pda A equivalent to the following context-free grammar :
 $S \rightarrow 0BB$
 $B \rightarrow 0S \mid 1S \mid 0$
 Test whether 010^3 is in $N(A)$
5. Attempt any two of the following :
- Define turing machine and universal turing machine using suitable diagrams. What are the properties of recursive and recursively enumerable languages ?
 - Explain unsolvable decision problem. Write in short on undecidability of post correspondence problem and Halting problem of turing machine.
 - Explain the language acceptability by turing machine in short. What are the steps to construct a type-0 grammar generating the set accepted by a given turing machine.