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

PAPER ID : 1071 Roll No.

B.Tech.

(SEM IV) EVEN SEMESTER THEORY EXAMINATION, 2009-2010

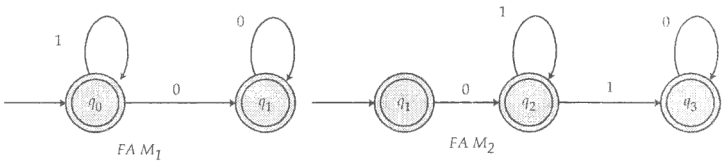
THEORY OF AUTOMATA AND FORMAL LANGUAGES

Time : 3 Hours *Total Marks : 100*

Note : *Answer **ALL** questions.*

1. Attempt **any four** of the following : **(4x5=20)**

(a) Explain the condition in which two Machines M_1 and M_2 are said to be equivalent. Give the difference and similarity between the following finite automata.



(b) Explain the modification done in FA to make it :

(i) Two-way Finite Automata

(ii) Push Down Automata

(iii) Turing Machine

(c) Convert following Mealy machine into equivalent Moore machine :

Present State	*Next State*			
	$a = 0$	*output*	$a = 1$	*output*
→ q1	q4	0	q2	1
q2	q2	1	q3	0
q3	q3	0	q4	0
q4	q4	0	q1	0

(d) Explain Chomsky Hierarchy of languages. Determine the type of following grammar :

$S \rightarrow aAb \mid \Lambda$, $A \rightarrow aA \mid Ab \mid a \mid b$

(e) Find the language generated by following grammar :

$S \rightarrow aAb \mid ab$, $A \rightarrow bAa$, $A \rightarrow \Lambda$

2. Attempt **any four** of the following : **(4x5=20)**

(a) Give the regular expression or FA for :

(i) The set of all strings over {0, 1} containing exactly two 0's.

(ii) The set of all strings over {0, 1} that does not end with 01.

(b) What do you understand by generalized transition graph (GTG) ? Construct transition diagram (finite automata without Λ-moves) of the following regular expression :

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

(c) Construct context free and context sensitive grammars for language

$L = \{0^n\ 1^{3n} \mid n \geq 1\}$

(d) Prove that the language $L = \{ a^n b^m \mid m \neq n\}$ is not regular by using Pumping Lemma.

(e) Find left-most, rightmost derivations and construct trees for yield 00110101 from the following grammar :

$S \rightarrow 0B \mid 1A,\ A \rightarrow 1AA \mid 0S \mid 0,\ B \rightarrow 0BB \mid 1S \mid 1.$

Where terminals are 0 & 1.

Is this grammar ambiguous ?

3. Attempt **any four** of the following : **(4x5=20)**

(a) Let $G_1 = [\{A, B\}, \{0, 1\}, \{B \rightarrow AB \mid \Lambda,\ A \rightarrow 011 \mid 1\}, A]$

with $L(G_1) = L_1$

and $G_2 = [\{C, D\}, \{0, 1\}, \{C \rightarrow DC \mid 01,\ D \rightarrow 01\}, C]$

with $L(G_2) = L_2$

Determine grammar G such that

$L(G) = (L_1 \cup L_2)^*$.

(b) What is inherent ambiguity ? Show that the language :

$L = \{a^n b^n c^m d^m \mid m,n \geq 1\} \cup \{a^n b^m c^m d^n \mid m,n \geq 1\}$

is inherently ambiguous.

(c) Construct context free grammar that can generate the strings represented by regular expression (00 + 1*)*0(11 + 0)*

(d) Construct PDA M to accept the language having equal number of 0's and 1's.

(e) Explain Church Thesis and Universal Turing Machine.

Attempt **any two** of the following : **(2x10=20)**

(a) Construct reduced grammar G_2 from following grammar G_1 such that every symbol appears in some sentential from :

$S \rightarrow AB,\ A \rightarrow b,\ B \rightarrow a,\ C \rightarrow D,\ E \rightarrow a$

Convert G_2 in Chomsky Normal Form.

(b) Explain MPCP. Does the following PCP have a solution ?

$A = (10, 01, 0, 100, 1),$

$B = (101, 100, 10, 0, 010)$

(c) If there is some PDA M_1 to accept CFL L by final state then show that there also exists another PDA M_2 that accept L by null (empty) store.

Attempt **any two** of the following : **(2x10=20)**

(a) Design Two-Stack PDA to accept the language

$L = \{a^n\, b^n\, c^n \mid n \geq 0\}$

(b) Construct a Turing machine to accept the language $L = \{0^n\, 1^n\, 2^n \mid n \geq 0\}$.

(c) Prove that arbitrary context free grammars G_1 and G_2, the problem "$L(G_1) \cap L(G_2)$ is context free" and is undecidable.

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