(Please write your Exam Roll No.) *Exam Roll No.*

END TERM EXAMINATION

SECOND SEMESTER (MCA) MAY 2009

Paper Code: MCA-104	***Subject: Theory of Computation***
Paper Id: 44104	***(Batch: 2004-2008)***

Time : 3 Hours ***Maximum Marks:60***

Note: Q1. is compulsory. Attempt one question from each section.

(2x10=20)

Q1. (a) Draw a DFA for language L in $\Sigma=\{0, 1\}$ such that a 0 is always followed by a 1.

(b) Find the language generated by a grammar having productions $S \rightarrow Aa$, $A \rightarrow bB$, $B \rightarrow aB$, $B \rightarrow c$.

(c) How a deviatior tree is useful for determining whether a word belongs to the language generated by a grammar? Can it be used for CSG?

(d) Outline fundamental differences between L-systems of Grammar and that of Chomsky grammar.

(e) Define an ambiguous grammar. Give an example of such a grammar.

(f) Give a recursive formula for addition of two positive numbers using initial functions like zero, identity and successor functions.

(g) When a problem is called of P-class? Give an example of problem that belongs to P class.

(h) Describe in words the language represented by the regular expression b*(a+b)*ab*

(I) Give a matrix grammar for $\{a^n\, b^n\, c^n \mid n > 0\}$

(J) Define Turing Thesis. When a problem is called undecidable?

SECTION-I

Q2. (a) Draw a Finite State-Machine that accepts a number divisible by 5. The allowable digits for number representation are 1, 2, 3 & 5 i.e $\sum = 1, 2, 3, 5\}$

(b) Show that if M is a Moore machine then there exists a corresponding Mealy machine. (5,5)

Q3. (a) Prove that $\{awa \mid w \in \{a, b\}^*\}$ is a regular language.

(b) Prove that the following two grammar generate same language

G_1: $S \rightarrow aS$, $S \rightarrow bA$, $A \rightarrow aA$, $A \rightarrow b$

G_2: $S \rightarrow aS$, $S \rightarrow Ab$, $A \rightarrow Aa$, $A \rightarrow b$ (5,5)

SECTION-II

Q4. (a) Show that CFL is not closed under the operation of intersection.

(b) Draw/design a Push Down Automata for the language $L=\{a^n cb^n \mid n \geq 0\}$. (5,5)

Q5. Consider the language L specified by the grammar G = $(N, \sum, P, S)$, where $N = \{S, A, B\}$, $\sum= (a, b, c\}$ and P is set containing following productions:

1. $S \rightarrow AB$
2. $A \rightarrow ab$
3. $A \rightarrow aAb$
4. $B \rightarrow c$

5. $B \rightarrow Bc$

(a) Determine whether each of the following strings is a sentence in the language.

aabb   aaabbc   aaabbbccc   ababcc

(b) Find the language L produced by the grammar. (4,6)

SECTION-III

Q6. (a) Write brief notes on partial recursive function. (5)

(b) What are prioritized rules in Markov algorithm? Describe the concept with the help of a suitable example. (5)

Q7. Prove that the grammar

1. $S \rightarrow ACaB$

2. $Ca \rightarrow aaC$

3. $CB \rightarrow DB$

4. $CB \rightarrow E$

5. $aD \rightarrow Da$

6. $AD \rightarrow AC$

7. $aE \rightarrow Ea$

8. $AE \rightarrow \epsilon$

Generates language $L = \{a^n \mid n \text{ is an integral power of } 2\}$. Specify all steps of derivations. (10)

SECTION – IV

Q8. (a) Show that proper subtraction is a total computable function.

(b) Define Post correspondence Problem (PCP). Show that S = {(b, bbb), babbb, ba), (ba, a)} has a solution over $\sum$ = {a, b}. (5,5)

Q9. (a) Draw a Turing machine for addition of two positive integers.

(b) Briefly explain the concept of computational complexity. Give an example of algorithm that is NP completer. (5,5)

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