CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY

Sixth Semester of B. Tech. Examination (CE)
May 2013
CE306 Theory of Computation (TOC)

Date: 02.05.2013, Thursday **Time: 10:00 a.m. To 01:00 p.m.** **Maximum Marks: 70**

Instructions:

1. The question paper comprises of two sections.
2. Section I and II must be attempted in separate answer sheets.
3. Make suitable assumptions and draw neat figures wherever required.
4. Rough work is to be done in the last page of main supplementary, please don't write anything on the question paper.
5. Indicate clearly, the option(s) you attempt along with its respective question no.
6. Figures to the right indicate marks.

SECTION-I

Q-1 **Answer the following questions.**

1. Define: The *Strong* Principle of Mathematical Induction. 2
2. Define: Acceptance by a Finite Automaton 2
3. Define: Strings Distinguishable with Respect to L. 3
4. Find a regular expression corresponding to each of the following subsets of $\{0,1\}^*$. 4
   a) The language of all strings not containing the substring 000.
   b) The language of all strings containing both 101 and 010 as substrings.

Q-2

[A] Prove Kleene's Theorem (Part 1). Any regular Language can be accepted by a finite automaton. 4

OR

[A] Draw an Finite Automata for the following Language: 4
   a. $(1+110)^*0$
   b. $(1+10+110)^*0$

[B] Convert the given CFG to Chamsky Normal form. 4
S → AACD
A → aAb|^
C→aC|a
D → aDa|bDb|^

[C] Prove using pumping lemma tha language $L=\{0^i1^i / i>=0\}$ is not regular. 4

OR

[C] Give the definition of Principle of Mathematical Induction. Prove that for any $n>=0$, $1+\sum i^* i! = (n+1)!$ 4

Q-3

[A] Draw a DPDA accepting Balanced strings of Brackets. 4
S → SS | [S] | {S} | ^

OR

[A] Find Context Free Grammar generating following language 4
   1. $0^m1^n2^p3^q$, where m+n = p+q
   2. The set of odd length strings in {a,b}* whose first, middle and last symbols are all the same.

[B] Define distinguishable string with respect to L. Using it prove that language pal of palindrome is non-regular. 4

[C] Define Turing Machine. And also throw light on how it is most powerful machine as compared to DFA, NFA and PDA. 4

OR

[C] Show that if L1 and L2 are context free languages then L1 union L2 and L1 L2 and L1* are also context free languages. 4

SECTION-II

Q-4

1. Give Chomsky-hierarchy for grammars. 2
2. Define equivalence relation and prove for any fixed positive integer n, the congruence Relation = n on the set N is an equivalence relation. 5
3. What is need for a Universal Turing Machine? Explain in brief. 4

Q-5

[A] Drwa a Push Down Automata accepting the langauge of even length Palindromes over {a,b}. 3

[B] Construct a turing machine for reversing a string. 3

[C] Let $M1$ and $M2$ be the FAs pictured in Figure a and Figure b, accepting languages $L1$ and $L2$, respectively. Draw FAs accepting the following languages. 6

a. $L1 \cup L2$ **b.** $L1 \cap L2$ **c.** $L1 - L2$

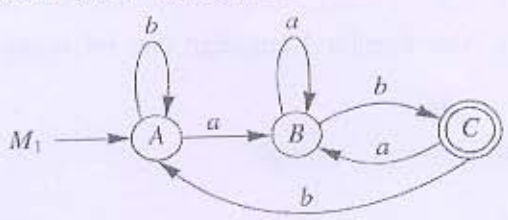

Figure a

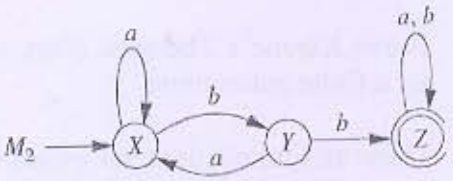

Figure b

OR

Q-5

[A] Construct a turing machine to compute n mod 3. 4

[B] Minimize the following DFA into equivalent machine accepting same Lang. 4