CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY

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

Date: 05.12.2013, Thursday **Time: 1:30 p.m. To 04:30 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 **DFA** and **justify** the statement: **NFA** is more powerful than **DFA**. 2
2. Any sentence produced by a grammar that has a unique parse tree is said to be an ambiguous grammar. **Justify.** 2
3. The **RE: 0* (10)*** denotes the same set as **(1*0)*1*** 2
4. Define a **CFG** for the **L= { $a^m b^n$ \| n>m}** 3
5. Show that a given **CFG** is ambiguous: **S→ ABA A→ aA | ^ B→ bB |^** 2

Q-2

[A] Construct and demonstrate **NFA** to **DFA** conversion for the **RE: (a |b)* a b*a** 4

OR

[A] Prove that for any *NFA* **M= (Q, Σ, q0, A, δ)** accepting a language **L**, subset of Σ^*, there is a *FA* **M1(= (Q_1, Σ, q_1, A_1, δ_1)** that also accepts **L**. 4

[B] Generate the **RE** for the given *CFG* below: Give automata for the Grammar (Language) and write what is the **L** accepted by the automata? 4
S→ aS | bS | a |b

[C] Prove that for any string x belongs to Σ^* and any **n>= 0** $(x^{rev})^{rev} = x$. 4

OR

[C] Prove that for any sets A, B and C if **AB = ϕ** and **C** is a subset of **B** then **AC = ϕ**. 4

Q-3

[A] Construct *NFA* for: **10+(0+11)0*1** 4

OR

[A] Design the **CFGs** in the 4-tuple form **(V, T, P, S)** for the given languages over the alphabet (a, b). 4

1. All strings having at least two **a's**
2. All possible strings not containing triple **b's**

[B] 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

[C] **Find a regular expression corresponding to each of the following subsets of {0, 1}*.** 4

1. The language of all strings not containing the substring 000.
2. The language of all strings containing both 101 and 010 as substrings.

OR

[C] Prove using mathematical induction that for every nonnegative integer n, 4

$$1 + \sum_{i=1}^{n} i * i! = (n+1)!$$

SECTION-II

Q-4

1. **Define:** Acceptance by Deterministic PDA. 3
2. **Define:** Recursive language and Recursive Enumerable languages. 4
3. Let L (V T P S) be a context free grammar, define PDA 'M' such that **L(M)= L(G).** 4

Q-5

[A] Construct a top-down **PDA** for { x belongs to {a,b}*| x is a Palindrome} 3

[B] Construct a turing machine for: **(a|b)*aba** 3

[C] **Write a short note on the following:** 6

1. Derivation tree and ambiguity
2. Pumping lemma for CFG

OR

Q-5

[A] Construct a turing machine for odd length palindrom. 4

[B] Convert the following **CFG** and into **CNF**: 4

S→ aSa | bSb | ∧

A→ aBb | bBa

B→aB |bB |∧

[C] Discuss: **P problem, NP problem, Decision Problem** and **Applications of Computational Theory**. 4

Q-6

[A] Prove using pumping lemma that language **L={0^i1^i / i>=0}** is not regular. 4

[B] Define: Strings Distinguishable with Respect to **L**. 4

OR

[B] 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

[C] Draw a **Push Down Automata** accepting the langauge of **even length Palindromes over {a,b}**. 4

OR

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