**National College of Computer** **Studies**

**(NCCS-College of IT & Management)**

**Final Examination (2013)**

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| **BSc.CSIT/ Fourth Semester/ CSC 251:Theory of Computation** |

***Candidates are required to answer the questions in their own words as far as practicable.***

**Full Marks: 80**

**Pass Marks: 40**

**Time: 3 Hours**



**Set A**

**Group-A**

**Attempt all questions: [8×4=32]**

1. Define finite automata with ε-moves. Is ε-NFA has more computation power than DFA?
2. Give the DFA accepting the string over {0, 1} such that each string is divisible by 2 but not by 4.
3. Define the term parse tree, regular grammar, useful symbols and ambiguous grammar.
4. Explain CNF SAT problem with suitable example.
5. Convert the following grammar into CNF.

S→AAC, A→aAb|∈, C→aC|a

1. What is unrestricted gramma? Give a unrestricted grammar for language L={anbncn |n>=1}
2. How a CFG can be constructed into PDA? Convert the following CFG into PDA

S→aAB, A→aS|bS|a, B→Sa|Sb|b

1. Explain recursive and recursively enumerable language.

Or

What is Turing machine? Give the Instantaneous description (ID) of TM.

**Group B**

**Attempt all questions: [6×8=48]**

1. Design the TM accepting language of palindrome over {0, 1} and show the acceptance of 10101.

Or

Show that every language accepted by multi tape TM is recursively enumerable.

1. Show that the language L accepted by some DFA if and only if L is accepted by some NFA.
2. State and prove pumping lemma for regular language. Show by example how it can be used to prove a language is not regular.
3. Describe universal TM and its operations. What types of language s are accepted by Universal TM?
4. What is PDA? Design a PDA a accepting language of palindrome over {a, b}. draw a computation tree for baab.
5. Write short notes on:
6. Time and space complexity of NTM
7. Unversal TM
8. Class P
9. PCP

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**Set B**

**Group-A**

**Attempt all questions: [8×4=32]**

1. What is DFA? How it differ from NFA? Explain.
2. Give the DFA accepting the string over {0, 1} such that each string not ending with 11
3. Show that complement of regular language is regular.
4. What is regular expression? Give a regular expression that denotes string over {0, 1} which is divisible by 2 but not by 4.
5. What is intractability? What is class P and NP? And differentiate between class P and NP.
6. For the following grammar with production

P={S→A1B, A→0A|ε, B→ 0B|1B|ε}

Draw a parse tree for 000110011

1. Give a formal definition a NPDA? How it differ from PDA? Explain.
2. Give a formal definition of TM? How a TM differ from other machines.

OR

Explain satisfiability problem with suitable example.

**Group B**

**Attempt all questions: [6×8=48]**

1. Explain about multi-tape TM. Show that every language by multi-tape TM is also accepted by one tape TM.
2. State and prove pumping lemma for regular language. Show that L={0m1n0m+n|m>=1, n>=1} is not regular language.

Or

Define recursively enumerable language. Give the Turing machine accepting language {0n1n|n>=1}. And show the acceptance of 0011.

1. What is CNF. Convert the following grammar into CNF

S→ASB|ε

A→aAS|a

B→SbS|A|bb

1. Explain about the Chomsky hierarchy of language.

Or

What is universal TM? What is the language accepted by Universal TM. And show that Lu  is not recursive.

1. Design a PDA accepting L={wwr|w∈(0+1)\*}. And give the complete moves for acceptance of 1001001.
2. Write short notes on:
3. Decidable Vs undecidable problem.
4. Unrestricted grammar
5. NP-completeness.
6. Halting problem.

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