**Kathmandu BernHardt College**

**Bafal, Kathmandu**

**Pre-Board Examination -2070**

**Faculty: Science Set ‘A’ FM: 60**

**Subject: Theory of Computation.**(CSC 251) **PM: 24**

**Level: BSc CSIT IV SEM Time: 3 hrs**

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate full marks.

**Group-A**

**Attempt all questions: [8×4=32]**

1. Define NFA. How it differ from DFA? Is NFA has more computation power than DFA?
2. Construct a DFA that accepts all string over Σ={a,b} start with ab and end with abb.
3. Define the term parse tree, regular grammar, useful symbols and ambiguous grammar.
4. Explain SAT problem with suitable example.
5. Let G be the grammar with production

S→aB|bA

A→a|aS|bAA

B→b|bs|aBB

For the following string **aabbbabababab**. Find leftmost, rightmost and parse tree.

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.

**Group B**

**Attempt all questions: [6×8=48]**

1. Give formal definition of TM. And design the TM accepting language of palindrome over {0, 1} and show the acceptance of 1001**. 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? **OR**

Explain about the Chomsky hierarchy of language.

1. What is PDA? Design a PDA a accepting language of palindrome over {a, b}. draw a computation tree for baab.
2. Write short notes on:
3. Time and space complexity of NTM b) Universal TM c)Class P d) PCP

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**Group B Attempt all questions: [6×8=48]**

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**Faculty: Science Set ‘B’ FM: 60**

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**Attempt all questions: Group A [8×4=32]**

1. What is DFA? When two DFA are equivalent, explain with examples.
2. Construct the DFA that accept all string that don not end with ba. Assume Σ={a,b}
3. Show that complement of regular language is regular.
4. What is regular expression? Write a RE describing a language over {0, 1} that end with 001 and containing 101 as a substring.
5. What is intractability? What is class P and NP? And differentiate between class P and NP.
6. Write a CFG that generates the following sets over {a, b}

{aibi+1| i>=1}. And draw a parse tree for aaabbbb.

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.

**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→0A0|1B1|BB, A→C, B→S|A, C→S|ε

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. b) Satisfiability problem c)NP-completeness. d)Halting problem.

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