Tribhuvan University
Institute of Science and Technology
2080
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Bachelor Level / Second Year/ Forth Semester/ Science
Computer Science and Information Technology (CSC 257)
(Theory of Computation)
(NEW COURSE)

Full Marks: 60
Pass Marks: 24
Time: 3 hours.

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

Section A

Long Answer Questions.
Attempt any TWO questions.

[2×10=20]

1. Describe the extended transition function of NFA. Construct a NFA, using transition table and transition diagram, over $\Sigma =\{0, 1\}$ that accepts the strings having substring 01 and ends with 1. Show the acceptance of 0111. [2+6+2]

2. Define CFG. Construct a CFG that generates the language of all palindromes over $\Sigma = \{a, b\}$ that do not contain the substring aa. Show the leftmost derivation and construct the equivalent parse tree for string babbbab. [2+5+3]

3. How Turing Machine is used as a computing function? Construct a TM for simulating a function $f(x)=2x$ for $x=\{1\}$. Iterate the TM for input 11 and generate the output 1111. [3+5+2]

Section B

Short Answer Questions
Attempt any EIGHT questions.

[8×5=40]

4. Differentiate Kleen closure from Positive closure. Compute Positive and Kleen closure of {ab}. [3+2]

5. Design a Mealy machine over $\Sigma =\{a, b\}$ that generates output 'A' if the input string ends with aa else output 'B' if the string ends with bb. [5]

6. Construct regular expression over {1....9}that represents [5]
    a. strings of even numbers with length 4 starting with 2 and ending with 8
    b. strings starting with odd numbers and ending with even numbers

7. Prove that the language $L = \{a^n b^n c^n / n \geq 0\}$ is not context free. [5]

8. Construct a PDA that accepts strings over $\Sigma =\{a,b\}$ that contains equal number of a's followed by equal number of b's. Show acceptance of aabb and aab. [4+1]

9. Describe how multi-stack TM is different from the semi-infinite tape TM? [5]

10. What is intractability? Define time and space complexity of Turing Machine. [2+3]

11. How conversion of PDA to CFG is done? Illustrate with an example [5]

12. State Arden's theorem. Convert following DFA into its regular expression using Arden theorem. [1.5+3.5]

	0	1
→*Q1	Q1	Q2
Q2	Q3	Q2
Q3	Q1	Q2