Tribhuvan University

Institute of Science and Technology

2078

Bachelor Level / fourth-semester / Science
Computer Science and Information Technology(CSC257)
Theory of Computation

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Time: 3 Hours

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

Long Answer Questions

Attempt any two Questions (2 x 10 = 20)

1 Give the formal definition of DFA and NFA. How NFA can be converted into eqivalent DFA? Explain with suitable example.

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2 Find the minimum state DFA for the given DFA below:

States	Input	
	0	1
A	B	F
B	E	C
C	B	D
*D	E	F
E	B	C
F	B	A

---

3 Construct a Turing Machine that accepts the language of odd length strings over alphabet {a, b}. Give the complete encoding for this TM as well as its input string w = abb in binary alphabet that is recognized by Universal Turing Machine.

Short Answer Questions

Attempt any Eight Questions

4 Define the term alphabet, prefix and suffix of string, concatenation and Kleen closure with example.

Give the regular expressions for the following language over alphabet {a, b}.

5
a. Set of all strings with substring bab or abb.
b. Set of all strings whose 3rd symbol is 'a' and 5th symbol is 'b'.

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6 Show that L = { a^n | n is a prime number } is not a regular language.

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7 Explain about the Chomsky's Hierarchy about the language and programs.

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8 Define a Push Down Automata. Construct a PDA that accepts L = {$a^n b^n$ | n > 0}

Construct the following grammer into Chomsky Normal Form.

9 S → abSb | a | aAb

A → bS | aAAb | ε

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10 Define Turing Machine and explain its different variations.

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11 Whar do you mean by computational Complexity? Explian about the time and space complexity of a Turing machine.

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12 Explain the term Intractability. Is SAT problem is intractable? Justify

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Section A

Attempt any Two questions. (2x10=20)

1. Define the NFA with ε-transition and ε-closure of a state. Show that for every regular expression r, representing a language L, there is ε-NFA accepting the same language. Also convert regular expression (a+b)*ab* into equivalent Finite Automata.

2. How can you define the language accepted by a PDA? Explain how a PDA accepting language by empty stack is converted into an equivalent PDA accepting by final state and vice-versa.

3. Define a Turing machine. Construct a TM that accept L = {wcw^R | w∈(0, 1) and c is ε or 0 or 1. Show that string 0110 is accepted by this TM with sequence of Instantaneous Description (ID).

Section B

Attempt any Eight questions. (8x5=40)

Give the formal definition of DFA. Construct a DFA accepting all strings of {0, 1} with

even number of 0's and even number of 1's.

5 Define Chomsky Normal Form and Greibach Normal Form in reference to CFG. Give a suitable example of each.

6 Give the regular expressions for following language over alphabet {0, 1}.

a. Set of all strings with 2^{nd} symbol from right is 1.
b. Set of all strings starting with 00 or 11 and ending with 10 or 01.

7 Show that language $L=\{0^m1^m \mid m>=1\}$ is not a regular language.

8 Describe the Turing machines with multiple tape, multiple track and storage in state.

9 Construct a NFA accepting language of {0, 1} with each string ending with 01 and convert it into equivalent DFA.

10 Construct a PDA accepting language over {0, 1} representing strings with equal no of 0s and1s. Show by sequence of IDs that 0101 is accepted by this PDA.

11 Define complexity of a Turing machine. Explain about big Oh, big Omega and big Theta notation used for complexity measurement.

12 What do you mean by tractable and Intractable problems? Explain with reference to TM.