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Name of Examination : **Winter 2020** - (Preview)

Course Code & Course Name : **CO303U - Formal Language and Automata Theory**

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Maximum Marks : **60**

Duration : **3 Hrs**

[Edit](#) [Print](#) [View Answer Key](#) [Close](#) **Answer Key Submission Type:** Marking scheme with model answers and solutions of numerical

Instructions:

1. All questions are compulsory.
2. Illustrate your answer with suitable figures/sketches wherever necessary.
3. Assume suitable additional data; if required.
4. Figures to the right indicate full marks.

1) Solve any two sub-questions.

a.) Construct a minimum state automata equivalent to the finite automata describe by the following table where q_0 is initial and q_2 is final state: [6]

| State / Σ | 0 | 1 |
|-------------------|-------|-------|
| $\Rightarrow q_0$ | q_1 | q_5 |
| q_1 | q_6 | q_2 |
| q_2 | q_0 | q_2 |
| q_3 | q_2 | q_6 |
| q_4 | q_7 | q_5 |
| q_5 | q_2 | q_6 |
| q_6 | q_6 | q_4 |
| q_7 | q_6 | q_2 |

b.) Define DFA and N DFA with suitable example. [6]

c.) Construct a Mealy Machine which is equivalent to the Moore Machine given by following table: [6]

| Present State | Next State | | Output |
|-------------------|------------|-------|--------|
| | a=0 | a=1 | |
| $\Rightarrow q_0$ | q_3 | q_1 | 0 |
| q_1 | q_1 | q_2 | 1 |
| q_2 | q_2 | q_3 | 0 |
| q_3 | q_3 | q_0 | 0 |

2) Solve any two sub-questions.

a.) Prove $(a+b)^* = a^*(ba)^*$. [6]

b.) Prove $(1+00^*1) + (1+00^*1)(0+10^*1)^*(0+10^*1) = 0^*1(0+10^*1)^*$. [6]

c.) Show that $L = \{0^i 1^i \mid i \geq 1\}$ is not regular. [6]

3) Solve any two sub-questions.

a.) Let G be the grammar $S \Rightarrow 0B|1A, A \Rightarrow 0|0S|1AA, B \Rightarrow 1|1S|0BB$. For the string 00110101, find: [6]

- (i) The leftmost derivation
- (ii) The rightmost derivation
- (iii) The derivation tree.

b.) Construct a reduced grammar equivalent to the grammar [6]

$S \Rightarrow aAa$
 $A \Rightarrow Sb|bCC|DaA$
 $C \Rightarrow abb|DD$
 $E \Rightarrow aC$
 $D \Rightarrow aDA$

c.) Construct a grammar in greibach normal form equivalent to the grammar [6]

$S \Rightarrow AA \mid a, A \Rightarrow SS \mid b$.

4) a.) Construct a PDA accepting $L = \{0^m 1^n 0^m \mid m, n \geq 1\}$. [6]

b.) Explain the model of linear bounded automaton. [6]

5) a.) Design a turing machine to recognise the language [6]

$\{1^n 2^n 3^n \mid n \geq 1\}$.

b.) Explain the Halting problem of Turing Machine. [6]

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