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CBCS SCHEME

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18CS54

Fifth Semester B.E. Degree Examination, Feb./Mar. 2022
Automata Theory and Computability

Time: 3 hrs. Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Define the following terms with examples :
i) Alphabet ii) String iii) Language iv) Concatenation at Languages
v) Power of an Alphabet. **(10 Marks)**

b. Define DFSM. Design DFSM
i) To accept strings having Even number of a's and even number b's
ii) To accept binary numbers divisible by 5. **(10 Marks)**

OR

2 a. Convert the following NDFSM of DFSM. [Refer Fig Q2(a)].

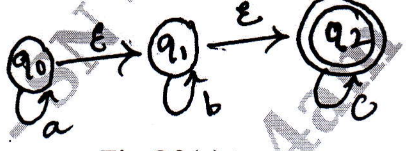

Fig Q2(a) **(08 Marks)**

b. Minimize the following DFSM by indentifying Distinguishable and Non-distinguishable states.

δ	0	1
→A	B	F
B	G	C
*C	A	C
D	C	G
E	H	F
F	C	G
G	G	F
H	G	C

(12 Marks)

Module-2

3 a. Define Regular Expression. Write RE for the following Languages. **(10 Marks)**
i) Strings of 0's and 1's ending with three consecutive zeroes.
ii) Strings of a's and b's having substring aa.

b. Write DFSM to accept intersection of Languages $L_1 = (a + b)^*a$ and $L_2 = (a + b)^*b$ **(10 Marks)**

OR

4 a. Using Kleen's theorem, prove that for any Regular Expression R, their exits a finite automata $M = (Q, \Sigma, \delta, q_0, F)$ which accepts L(R). **(10 Marks)**

b. State and prove pumping Lemma for Regular Languages. Show that the Language $L = \{ww^r : w \in (0, 1)^*\}$ is not regular. **(10 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-3

5 a. Define Context Free Grammar. Design CFG for the following Languages.
   i) $L_1 = \{w : |w| \text{ Mod } 3 = 0\}$ over $\Sigma = \{a\}$
   ii) $L_2 = \{a^n b^m c^k : m = n + k\}$ over $\Sigma = \{a, b, c\}$ **(10 Marks)**

b. Define Ambiguity. Consider the grammar
$E \rightarrow E + E \mid E * E \mid (E) \mid id$
Find Leftmost and Rightmost derivations and parse tree for the string id + id * id, show that the grammar is ambiguous. **(10 Marks)**

OR

6 a. What is Chomsky Normal Form of CFG? Convert the following grammar to CNF.
$S \rightarrow ABC \mid BaB$
$A \rightarrow aA \mid BaC \mid aaa$
$B \rightarrow bBb \mid a \mid D$
$C \rightarrow CA \mid AC$
$D \rightarrow \varepsilon$
Eliminate ε - productions, Unit productions and useless symbols if any before conversion. **(10 Marks)**

b. What is NPDA? Design NPDA for Language $L = \{a^n b^n \mid n \geq 1\}$. Draw transition diagram. Write sequence of moves made by NPDA to accept the string aaabbb. **(10 Marks)**

Module-4

7 a. Design TM for WCW^R over $\Sigma = \{0, 1\}$. Write transition diagram, and ID for w = 101C101 **(14 Marks)**

b. Explain : i) Multitape ii) Non-deterministic TM **(06 Marks)**

OR

8 a. Define Turning Machine. Explain the working of Turning Machine. **(06 Marks)**

b. Design Turning machine to accept the Language $L = \{0^n 1^n 2^n \mid n >= 0\}$. Draw the transition diagram. Write sequence of moves made by TM for string 001122. **(14 Marks)**

Module-5

9 a. Explain Halting problem in Turning machine. **(07 Marks)**

b. Write applications of Turning Machine. **(06 Marks)**

c. Explain Recursively Enumerable Languages. **(07 Marks)**

OR

10 a. Explain Quantum Computers. **(07 Marks)**

b. Explain P and NP classes. **(07 Marks)**

c. Explain Church Turning Thesis. **(06 Marks)**

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