CBCS SCHEME

USN | | | | | | | | | | |

15CS54

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021
Automata Theory and Computability

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define the following terms with example:
(i) Length of a string (ii) Reversal (iii) Proper substring
(iv) Language (v) Power of an alphabet **(05 Marks)**

b. Design a FSM to accept set of all strings that either begins or ends or both with substring ab. **(05 Marks)**

c. Convert the given NDFSM to DFSM. (Refer Fig.Q1(c))

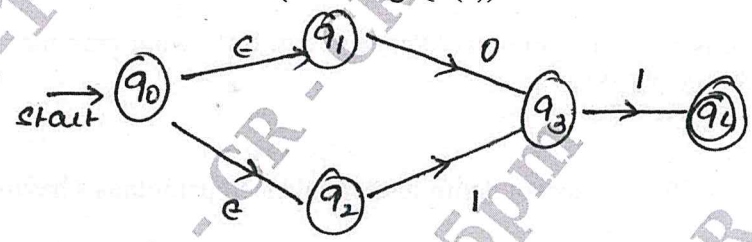

Fig.Q1(c) **(06 Marks)**

OR

2 a. Construct a minimized DFSM for the following: **(08 Marks)**

	↓ A	B	* C	D	E	* F	G	H	* I
0	B	C	D	E	F	G	H	I	A
1	E	F	H	H	I	B	B	C	E

b. Define NDFSM and construct NDFSM for the following languages:
(i) To recognize the following set of strings abc, abd and aacd
(ii) $L = \{w | w \in abab^n \text{ or } aba^n \text{ where } n \geq 0\}$
(iii) $L = \{w | w = aba \text{ or } |w| \text{ is even}\}$ **(08 Marks)**

Module-2

3 a. Define Regular expression. Obtain a regular expression for the following languages:
(i) $L = \{w : |w| \text{ is even}\}$
(ii) $L = \{w : \text{in w the } 5^{th} \text{ character from right is a and either character is b}\}$
(iii) $L = \{w : w \text{ contains both aa and aba as sub string}\}$ **(06 Marks)**

b. Construct FSM for the following RE:
(i) ab (ii) b + (ab) (iii) (b + (ab))* (iv) (babb* + a)* (v) (b + ∈) (ab)* (a + ∈) **(10 Marks)**

OR

4 a. Show that for every RE there is an equivalent FSM. **(05 Marks)**

b. Prove that the regular languages are closed under intersection and difference. **(06 Marks)**

c. Obtain RE from the following FSM. (Refer Fig.Q4(c))

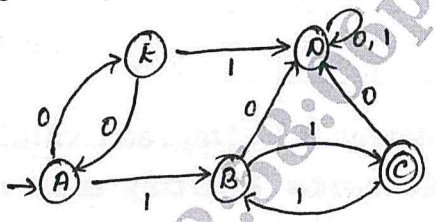

Fig.Q4(c) **(05 Marks)**

Module-3

5 a. Define context free grammar and write CFG for the following languages:
(i) $L = \{a^i b^j c^k : i + j = k, i \geq 0, j \geq 0\}$
(ii) $L = \{a^n b^m c^k : n + 2m = k\}$ **(06 Marks)**

b. Consider the grammar G, with productions:
$S \rightarrow AbB$
$A \rightarrow aA | \in$
$B \rightarrow aB | bB | \in$
Give the left most derivation, rightmost derivation and parse tree for the string aaabab. **(06 Marks)**

c. What is agbigous grammar? Prove that the following grammar is ambiqous on the string aab.
G: $S \rightarrow aS | aSbS | \in$ **(04 Marks)**

OR

6 a. Build a PDA to accept delimiters or balanced paranthesis having paranthesis {, (,) , }. **(08 Marks)**

b. Explain the following terms: (i) Pushdown Automata (PDA) (ii) Languages of a PDA **(04 Marks)**

c. Obtain a CFG for PDA M with the transitions:
$\delta(q_0, a, Z) = (q_0, AZ)$
$\delta(q_0, b, A) = (q_0, AA)$
$\delta(q_0, a, A) = (q_1, \in)$ **(04 Marks)**

Module-4

7 a. State and prove pumping Lemma for context free languages. **(06 Marks)**

b. Prove that $L = \{w \in \{a, b, c\}^* \text{ where } n_a(w) = n_b(w) = n_c(w)\}$ is not context free. **(04 Marks)**

c. Prove that the Context Free Languages are closed under, union and concatenation. **(06 Marks)**

OR

8 a. With a neat diagram, explain the working of a basic TM. **(06 Marks)**

b. Design a TM to accept the following language $L = \{0^n 1^n 2^n \mid n \geq 1\}$ **(10 Marks)**

Module-5

9 Write short notes on:
a. Multi Tape TM
b. Non Deterministic TM
c. Post Correspondence Problem **(16 Marks)**

OR

10 a. Prove that every Language accepted by a multitape TM is accepted by standard TM with single tape. **(06 Marks)**

b. Write note on: (i) Linear Bounded Automata (ii) Recursive Language **(10 Marks)**

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