CBCS SCHEME

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15CS54

Fifth Semester B.E. Degree Examination, Jan./Feb. 2023
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. Explain the different functions performed on strings with example. **(05 Marks)**

b. Define DFSM. Construct the DFSM for the language L = {w : w is the string representing floating numbers}. **(05 Marks)**

c. Draw a DFA to accept strings of a's and b's such that:
(i) Language has even number of a's and odd number of b's.
(ii) Language has not more than three a's. **(06 Marks)**

OR

2 a. Convert the following NDFSM to DFSM:

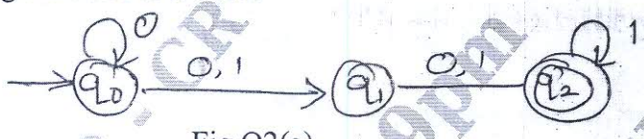

Fig.Q2(a) **(06 Marks)**

b. Minimize the following DFSM:

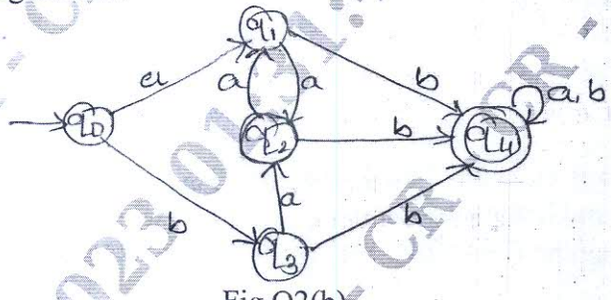

Fig.Q2(b) **(06 Marks)**

c. Define Moore machine and Mealy machine. **(04 Marks)**

Module-2

3 a. Define Regular Expression Work the RE for the languages.
$L = \{a^n b^m : (m + n) \text{ is even}\}$
L = {String of a's and b's whose 3rd symbol from right is a} **(06 Marks)**

b. Build a regular expression from an FSM.

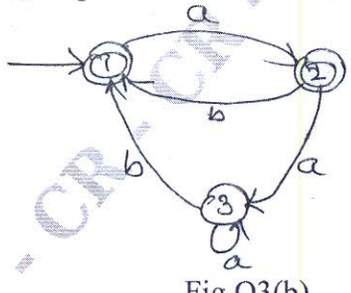

Fig.Q3(b) **(06 Marks)**

c. Convert regular expression (a + b)* b(a + b) to NDFSM. **(04 Marks)**

OR

4 a. State and prove the pumping lemma for regular languages. (06 Marks)

b. Show that the $L = \{a^n : n \text{ is prime}\}$ is not a regular. (04 Marks)

c. Prove that regular language are closed under complement, intersection, difference reverse and letter substitution. (06 Marks)

Module-3

5 a. Define Context Free Grammar. Write the grammar for balanced parentheses. (04 Marks)

b. When a grammar is said to be ambiguous, show that expression grammar is ambiguous. Write unambiguous grammar for the same. (08 Marks)

c. Eliminate $\in$-rules from the given grammar.

$S \rightarrow aTa$

$T \rightarrow ABC$

$A \rightarrow aA|C$

$B \rightarrow Bb|C$

$C \rightarrow C|\in$ (04 Marks)

OR

6 a. Define Push Down Automata. Construct the PDA for $L = \{a^n b^{2n} : w \in \{a, b\}^*\}$. Write transition diagram. Test that the "aaabbbbbb" string is accepted by the model or rejected by the model. (08 Marks)

b. Convert the following grammar to CNF:

$S \rightarrow aACa$

$A \rightarrow B|a$

$B \rightarrow C|c$

$C \rightarrow cC|\in$ (08 Marks)

Module-4

7 a. Prove that Content Free Languages are closed under union, concatenation, Kleene star, reverse and letter substitution. (08 Marks)

b. Show that the $L = \{a^n b^n c^n : n \geq 0\}$ is not a Content Free Language. (08 Marks)

OR

8 a. With a neat diagram, explain the working of Turing Machine. (04 Marks)

b. Explain different techniques for turing machine construction. (04 Marks)

c. Design a turing machine M to recognize the language $\{1^n 2^n 3^n \mid n \geq 1\}$ (08 Marks)

Module-5

9 a. Explain the variant turing machine models in detail. (08 Marks)

b. Explain the working of linear bounded automation. (08 Marks)

OR

10 Write short notes on the following:

a. Decidable and undecidable language

b. Halting problem of turing machine

c. Quantum computers

d. Church Turing Thesis (16 Marks)

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