CBCS SCHEME

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17CS54

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
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. Construct the DFA for the following language over $\Sigma = \{a, b\}$.
   i) Set of all strings ending with a and b
   ii) Set of all strings not containing the substring "aab"
   iii) Set of all strings with exactly three consecutive a′5.
   iv) Set of all strings at least one a″
   v) Set of all strings not end with abb″. **(15 Marks)**

   b. Define DFA difference between DFA and NFA. **(05 Marks)**

OR

2 a. Convert the following NFA to its equivalent DFA. **(10 Marks)**

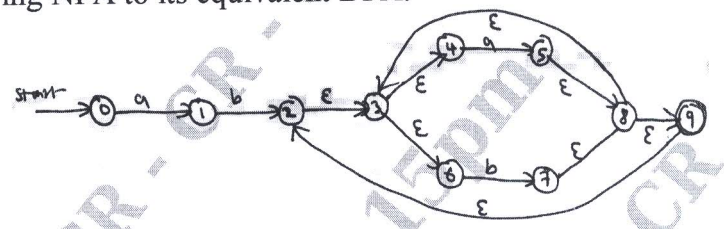

Fig.Q.2(a)

   b. Draw a DFA to accept decimal strings divisible by 3. **(10 Marks)**

Module-2

3 a. Define regular suppression write RE for the following:
   i) Language of all string of a′5 and b′5 having length 2.
   ii) Language of all string of a′5 and b′5 having even length.
   iii) Language of all string of a′5 and b′5 starting with 'a' and ending with 'b'. **(10 Marks)**

   b. State and prove pumping lemma regular language. **(10 Marks)**

OR

4 a. Prove the Kleene's theorem. **(10 Marks)**

   b. Write a note on state elimination technique with illustration. **(10 Marks)**

Module-3

5 a. Consider the grammer shown below from which any arithmetic suppression can be obtained.

$E \rightarrow E + E$
$E \rightarrow E - E$
$E \rightarrow E * E$
$E \rightarrow E / E$
$E \rightarrow (E) / I$
$I \rightarrow Id$

Show that the grammer is ambiguous. **(10 Marks)**

b. Let G = (V, T, P, S) be a CFG where
$V = \{S\}$
$T = \{a, b\}$
$P = \{S \rightarrow aSa \mid bSb \mid E\}$
S is the start symbol.
i) Generate some illustrative strings of the language.
ii) Prove that this language is context free. **(10 Marks)**

OR

6 a. Is the PDA to accept the language $L = \{W \mid W \in (a, b)^*$ and $n_a(w) > n_b(w)\}$ is deterministic? **(10 Marks)**

b. Obtain a PDA to accept the language $L = \{a^n b^n \mid n \geq 1\}$ by a final state. **(10 Marks)**

Module-4

7 a. Define CNF, prove the CNF theorem. **(10 Marks)**

b. Define GNF, prove the GNF theorem. **(10 Marks)**

OR

8 a. Explain in detail Turing Machine Model. **(10 Marks)**

b. Obtain a Turing machine to accept the language $L = \{0^n 1^n \mid n \geq 1\}$. **(10 Marks)**

Module-5

9 a. Explain the linear bounded automata. **(10 Marks)**

b. Explain the posts correspondence problem. **(10 Marks)**

OR

10 a. Write a short note on Church Turing thesis. **(10 Marks)**

b. Explain undecidable problem that are RE. **(05 Marks)**

c. Write a short note on Halting problem. **(05 Marks)**

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