CBCS SCHEME

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17CS54

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

Time: 3 hrs. Max. Marks: 100

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

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-1

1 a. Define Language, Grammer and Automata with examples. **(04 Marks)**

b. Define DFSM. Draw a DFSM to accept the Language.

i) $L = \{awa : w \in (a, b)^*\}$. Verify for the string aabaa.

ii) Set of an string having a substring abb over $\Sigma = \{a, b\}$. Verify for the string aabba. **(08 Marks)**

c. Convert the following NDFSM to its equivalent DFSM (Refer Fig Q1(c))

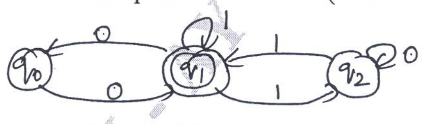

Fig Q1(c) **(08 Marks)**

OR

2 a. Constant an NDFSM for multiple keywords

$L = \{w \in (a, b)^* : \exists x, y \in \{a, b\}^*$ where

$((w = x\ abbaay) \vee (w = xbabay))\}$ **(04 Marks)**

b. Minimize the following Finite State Machine using partition method. (Refer Fig Q2(b))

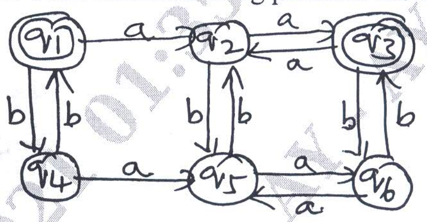

Fig Q2(b) **(08 Marks)**

c. Differentiate between DFSM, NDFSM and $\in$ - NDFSM with examples. **(08 Marks)**

Module-2

3 a. Define Regular expression? Obtain the Regular expression for the following languages.

i) $L = \{a^{2n} b^{2n+1} ; n \geq 0, m \geq 0\}$

ii) $L = \{a^n b^m ; n \geq 4, m \leq 3\}$

iii) Set of string of 0's and 1's whose 10^{th} symbol from the right end side is 1. Justify the answers. **(08 Marks)**

b. State and prove pumping Lemma for regular languages. **(08 Marks)**

c. Define Regular Grammer. Obtain Regular grammer for the language $L = \{w \in (a, b)^* ; w$ ends with the pattern aaaa$\}$. **(04 Marks)**

OR

4 a. Prove that for every regular defined by regular expression is also defined by Finite State Machine. **(08 Marks)**

b. Prove that the following Language is not regular

$L = \{ww^R ; w \in (0+1)^*$ is not regular$\}$ **(08 Marks)**

c. Construct an NFSM which accepts the regular expression $(a+b)^*abb$. **(04 Marks)**

Module-3

5 a. Define Context Free Grammer. Obtain the Context Free Grammer for the following :
   i) $L = \{ww^R : w \in (a, b)^*\}$
   ii) Write a CFG to generate balanced parenthesis
   Where Bal = {w ∈ {), (}* ; parenthesis are balanced}.
   Justify the answers. **(08 Marks)**

b. Define Leftmost and rightmost derivations with examples. **(04 Marks)**

c. What is ambiguous grammer? Show that the following grammer is ambiguous for the string id + id * id. $E \rightarrow E + E \mid E - E \mid E * E \mid E / E \mid id$ **(08 Marks)**

OR

6 a. Define PDA, and Instantaneous description of PDA. Obtain a PDA to accept the language. $L = \{wcw^R : w \in (a, b)^*\}$. Draw the transition diagram of PDA, show the moves by this PDA for the string abbcbba. **(10 Marks)**

b. What is CNF and GNF? Convert the grammer in CNF
   $S \rightarrow ABa$
   $A \rightarrow aab$
   $B \rightarrow Ac$ **(05 Marks)**

c. For the following CFG
   $S \rightarrow asbb/aab$
   Obtain the corresponding PDA. **(05 Marks)**

Module-4

7 a. State the prove Pumping Lemma theorem for Context Free Languages. **(08 Marks)**

b. Show that $L = \{a^n n^n c^n \mid n \geq 0\}$ is not context free. **(08 Marks)**

c. Remove all unit production from the grammer
   $S \rightarrow AB$
   $A \rightarrow a$
   $B \rightarrow C|b$
   $C \rightarrow D$
   $D \rightarrow E|bc$
   $E \rightarrow d|Ab$ **(04 Marks)**

OR

8 a. Explain with neat diagram, the working of a Turing Machine Model. **(06 Marks)**

b. Design a Turing Machine to accept the language $L = \{0^n 1^n 2^n \mid n \geq 1\}$. Draw the transition diagram. Show that moves made by this machine for the string 001122. **(10 Marks)**

c. Briefly explain the techniques for Turing Machine construction. **(04 Marks)**

Module-5

9 a. Design a Turing Machine to accept the language $L = \{0^n 1^n \mid n \geq 1\}$. Draw the transition diagram show the moves made by this machine for the string 000111. **(10 Marks)**

b. Explain the following :
   i) Multitape Turing machine
   ii) Post correspondence problem. **(10 Marks)**

OR

10 Write short notes on :
   a. Non Deterministic Turing Machine
   b. Halting Problem of Turing Machine
   c. Quantum Computation with example
   d. Model of linear bounded automation. **(20 Marks)**