

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.

Module-1

- 1 a. Define Language, Grammar 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 a 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. Construct an NDFSM for multiple keywords
 $L = \{w \in (a, b)^* : \exists x, y \in \{a, b\}^* \text{ where } ((w = xabbaay) \vee (w = xbabay))\}$ (04 Marks)
- b. Minimize the following Finite State Machine using partition method. (Refer Fig Q2(b))

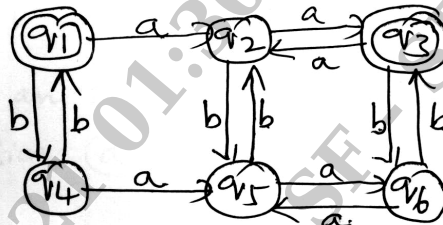


Fig Q2(b)

(08 Marks)

- c. Differentiate between DFSM, NDFSM and ϵ -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 10th 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 Grammar. Obtain Regular grammar for the language
 $L = \{w \in (a, b)^* ; w \text{ ends with the pattern } aaaa\}$. (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)

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. Obtain the Context Free Grammar for the following :
- $L = \{ww^R : w \in (a, b)^*\}$
 - Write a CFG to generate balanced parenthesis
Where $Bal = \{w \in \{, \}^* ; \text{parenthesis are balanced}\}$.
Justify the answers. (08 Marks)
- b. Define Leftmost and rightmost derivations with examples. (04 Marks)
- c. What is ambiguous grammar? Show that the following grammar 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 $abcbba$. (10 Marks)
- b. What is CNF and GNF? Convert the grammar 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 $L = \{a^n c^n \mid n \geq 0\}$ is not context free. (08 Marks)
- c. Remove all unit production from the grammar
 $S \rightarrow AB$
 $A \rightarrow a$
 $B \rightarrow C|b$
 $C \rightarrow D$
 $D \rightarrow E|bc$
 $E \rightarrow d|Ab$ (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 :
- Multitape Turing machine
 - Post correspondence problem. (10 Marks)

OR

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