

Fifth Semester B.E. Degree Examination, June/July 2019
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 : i) string ii) alphabet iii) language. (06 Marks)
 b. Design a deterministic finite state machine for the following language over $\Sigma = \{a, b\}$.
 i) $L = \{W \mid |W| \bmod 3 > |W| \bmod 2\}$
 ii) $L = \{w \mid W \text{ ends either with } ab \text{ or } ba\}$. (10 Marks)

OR

- 2 a. Write a note on finite state transducers. (07 Marks)
 b. Define DFSM? Minimize the following FSM. [Refer Fig.Q2(b)]

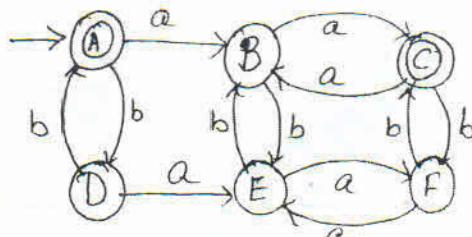


Fig.Q2(b)

(09 Marks)

Module-2

- 3 a. Write the equivalent Regular Expression for the given Finite state machine. [Refer Fig.Q3(a)] (08 Marks)

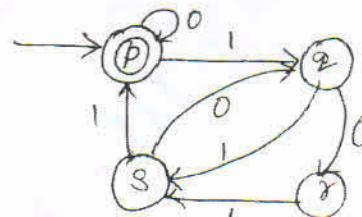


Fig Q3(a)

- b. Write the Regular Expression for the following language.
 i) $\{w \in \{a, b\}^* \mid w \text{ has atmost one } a\}$
 ii) $\{w \in \{a, b\}^* \mid w \text{ does not end with } ba\}$
 iii) $\{w \in \{0, 1\}^* \mid w \text{ has substring } 001\}$
 iv) $\{w \in \{0, 1\}^* \mid |w| \text{ is even}\}$. (08 Marks)

- 4 a. State and prove the pumping theorem for regular language. (08 Marks)
 b. Show that the language $L = \{a^n b^n \mid n \geq 0\}$ is not regular. (08 Marks)

Module-3

- 5 a. Define grammar. Write the CFG for the following language.
 i) $L = \{ w \in \{a, b\}^* \mid n_a(w) = n_b(w) \}$
 ii) $L = \{ a^i b^j \mid i = j + 1 \}$. (08 Marks)
- b. What is inherent ambiguity? Show that the language given is inherently ambiguous?
 $L = \{ a^n b^n c^m \mid n, m \geq 0 \} \cup \{ a^n b^m c^n \mid n, m \geq 0 \}$ (08 Marks)

OR

- 6 a. Define PDA? Design PDA for the language $L = \{ a^n b^m a^n \mid n, m \geq 0 \}$. (06 Marks)
- b. Convert the following language from CFG to PDA $L = \{ ww^R \mid w \in \{0, 1\}^* \}$. (06 Marks)
- c. Convert the following CFG to CNF $E \rightarrow E + E \mid E * E \mid (E) \mid id$. (04 Marks)

Module-4

- 7 a. Prove that the language $L = \{ a^n b^n c^n \mid n \geq 0 \}$ is not context free. (08 Marks)
- b. Prove that CFL are not closed under intersection, complement or difference? (08 Marks)

OR

- 8 a. Design a Turing machine to accept $L = \{ a^n b^n c^n \mid n \geq 0 \}$. (08 Marks)
- b. Define a turning machine. Explain the working of a turning machine. (05 Marks)
- c. Write a note on multitape machine. (03 Marks)

Module-5

- 9 Write a short notes on :
 a. Growth rate of function (05 Marks)
 b. Church-turning thesis (06 Marks)
 c. Linear bounded automata. (05 Marks)

OR

- 10 Write a short notes on :
 a. Post correspondence problem (05 Marks)
 b. Halting problem in turning machine (05 Marks)
 c. Various types of turning machine. (06 Marks)

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