

CBCS SCHEME

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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 the following with example:
 - i) String ii) Language iii) Alphabet iv) Symbol (04 Marks)
- b. Design a DFSM to accept each of the following language:
 - i) $L = \{w \in \{a, b\}^* ; w \text{ has all strings that ends with sub string } abb \}$
 - ii) $L = \{w ; \text{where } |w| \bmod 3 = 0 \text{ where } \Sigma = \{a\}\}$
 - iii) $L = \{w \in \{a, b\}^* \text{ every a region in } w \text{ is of even length.}\}$ (09 Marks)
- c. Construct an equivalent DFA from the following given NFA using subset construction method. (Refer Fig.Q.1(c)) (07 Marks)

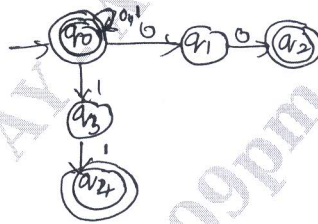


Fig.Q.1(c)

OR

- 2 a. Construct a minimum state automation equivalent to the FA given table

States	0	1
→q ₀	q ₁	q ₅
q ₁	q ₆	q ₂
⊙q ₂	q ₀	q ₂
q ₃	q ₂	q ₆
q ₄	q ₇	q ₅
q ₅	q ₂	q ₆
q ₆	q ₆	q ₄
q ₇	q ₆	q ₂

(10 Marks)

- b. Consider the following NFA with ϵ -moves construct on equivalent DFA.

(10 Marks)

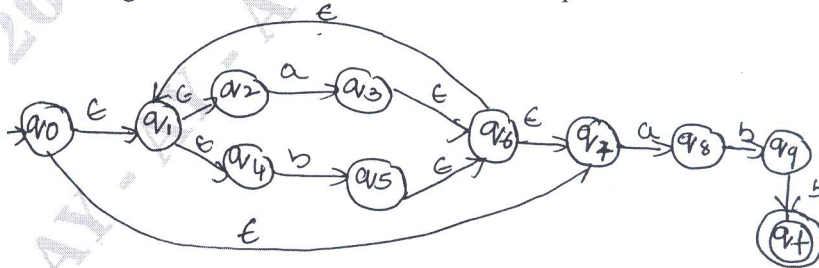


Fig.Q.2(b)

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-2

- 3 a. Define Regular expression. Write RE for the following languages:
- $L = \{a^n b^m \mid m + n \text{ is even}\}$
 - $L = \{a^n b^m \mid m \geq 1, n \geq 1, nm \geq 3\}$
 - $L = \{a^{2^n} b^{2^m} \mid n \geq 0, m \geq 0\}$ (10 Marks)
- b. Construct an ϵ -NFA for the regular expression $0 + 01^*$ (05 Marks)
- c. Construct on FA for the regular expression $10 + (0 + 11)0^*1$ (05 Marks)

OR

- 4 a. State and prove pumping lemma theorem for regular languages. (08 Marks)
- b. Prove that $L = \{a^p \mid p \text{ is a prime}\}$ is not a regular. (08 Marks)
- c. List out closure properties of regular sets. (04 Marks)

Module-3

- 5 a. Define CFG. Write a CFG to specify
- all string over $\{a, b\}$ that are even and odd palindromes.
 - $L = \{a^n b^{2n} \text{ over } \Sigma = \{a, b\}, n \geq 1\}$ (10 Marks)
- b. Write the procedure for removal of ϵ -productions. Simplify the following grammar.
- $S \rightarrow aA \mid aBB$
 $A \rightarrow aAA \mid \epsilon$
 $B \rightarrow bB \mid bbC$
 $C \rightarrow B$ (10 Marks)

OR

- 6 a. Define PDA. Design a PDA for the language that accepts the string with $n_a(w) < n_b(w)$ where $w \in (a + b)^*$ and show the instantaneous description of the PDA on input abbab. (10 Marks)
- b. What is CNF and GNF? Convert the following grammar into GNF.
- $S \rightarrow AA \mid a$
 $A \rightarrow SS \mid b$ (10 Marks)

Module-4

- 7 a. With a neat diagram, explain variant of turning machine. (10 Marks)
- b. Construct a Turning machine that accept the language $0^n, 1^n$ where $n > 1$ and draw transition graph for Turning Machine. (10 Marks)

OR

- 8 a. Define Turning Machine with its tuples. (04 Marks)
- b. Explain the working principle of Turning Machine with diagram. Design a Turing Machine to accept strings formed on $\{0, 1\}$ and ending with 000. Write transition diagram and ID for $w = 101000$. (16 Marks)

Module-5

- 9 a. Explain restricted turing machines. (08 Marks)
- b. Explain the following with example:
- Decidability
 - Decidable languages
 - Undecidable languages. (12 Marks)

OR

- 10 Write a short note on:
- Post correspondence problem
 - Halting problems in Turning Machine
 - Linear Bound Automation (LBA)
 - Classes of P and NP (20 Marks)

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