CBCS SCHEME

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18CS54

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 has all strings that ends with sub string abb $\}$
ii) $L = \{w;$ where $|w| \bmod 3 = 0$ where $\Sigma = \{a\}\}$
iii) $L = \{w \in \{a, b\}^*$ every a region in w 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)**

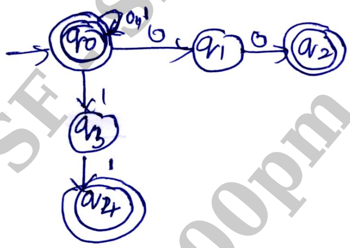

Fig.Q.1(c)

OR

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

States	0	1
$\rightarrow q_0$	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 $\in$-moves construct on equivalent DFA. **(10 Marks)**

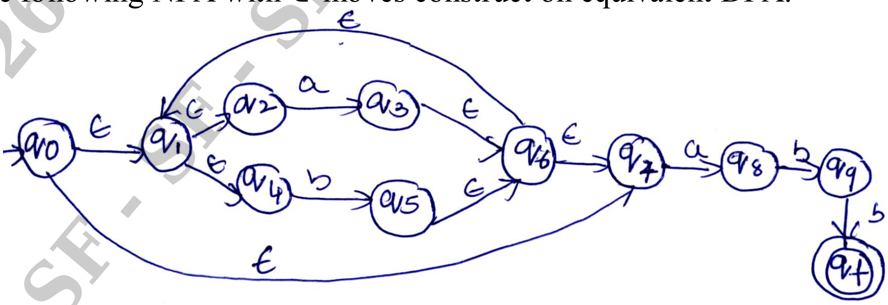

Fig.Q.2(b)

Module-2

3 a. Define Regular expression. Write RE for the following languages:

i) $L = \{a^n b^m \mid m + n \text{ is even}\}$

ii) $L = \{a^n b^m \mid m \geq 1 \; n \geq 1 \; nm \geq 3\}$

iii) $L = \{a^{2n} b^{2m} \mid n \geq 0, m \geq 0\}$ **(10 Marks)**

b. Construct an $\in$ - 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

i) all string over {a, b} that are even and odd palindromes.

ii) $L = \{a^n b^{2n} \text{ over } \Sigma = \{a, b\} n \geq 1\}$ **(10 Marks)**

b. Write the procedure for removal of $\in$-productions. Simplify the following grammar.

$S \to aA \mid aBB$

$A \to aAA \mid \in$

$B \to bB \mid bbC$

$C \to B$ **(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 $w \in \mid (a + b)^*$ 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.

$S \to AA \mid a$

$A \to SS \mid b$ **(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:

i) Decidability ii) Decidable languages iii) Undecidable languages. **(12 Marks)**

OR

10 Write a short note on:

a. Post correspondence problem

b. Halting problems in Turning Machine

c. Linear Bound Automation (LBA)

d. Classes of P and NP **(20 Marks)**

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