BACHELOR OF SCIENCE (COMPUTER SCIENCE) (CBCS - 2018 COURSE)
T.Y.B.Sc.(Computer Science) Sem-V : WINTER- 2022
SUBJECT : THEORETICAL COMPUTER SCIENCE

Day : Friday   Time : 02:00 PM-05:00 PM
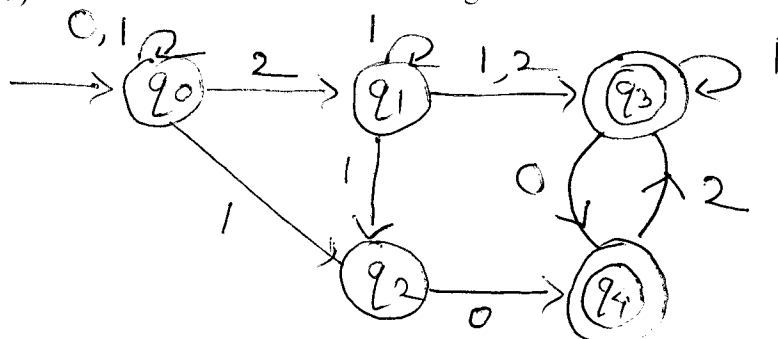
Date : 9/12/2022   **W-20116-2022**   Max. Marks : 60

N.B.:
1) All questions are **COMPULSORY**.
2) Figures to the **RIGHT** indicate **FULL** marks.
3) Draw neat labeled diagram **WHEREVER** necessary.

Q.1 Attempt **ANY TWO** of the following: **[12]**

a) Construct DFA for the following NFA

b) Define Mealy machine. Construct Mealy machine which outputs even or odd according to number of 1's encountered is even or odd over $\{0, 1\}$. Draw state table.

c) Define DFA. Construct a DFA to accept the set of all strings over $\{0, 1\}$ such that every pair of adjacent 0's appear before any pair of adjacent 1's. draw state transition table.

Q.2 Attempt **ANY TWO** of the following: **[12]**

a) Prove that the regular sets are closed under complementation with an example.

b) Convert the following CFG into equivalent CNF.

$S \rightarrow ASA \mid aB$

$A \rightarrow Ba \mid S$

$B \rightarrow b \mid \varepsilon$

c) Construct a FA(NFA with ε) for the language having regular expression:

$(0^* + 1^*)^* + (01)^*$

Q.3 Attempt **ANY TWO** of the following: **[12]**

a) Define PDA. Construct PDA for $L = \{a^m b^m \mid m >= 1\}$.

b) Construct TM for a language $L = \{a^n b^m c^n \mid n, m >= 0\}$.

c) Construct a DFA to accept the set of all strings over $\{0, 1\}$, such that every pair of adjacent 0's appear before any pair of adjacent 1's. Draw state transition table.

P.T.O.

Q.4 Attempt **ANY THREE** of the following: [12]

    a) Construct regular expression for the following languages:

        i) String of even length over {a}

        ii) String over {0, 1} containing 01 at the end.

    b) Define CFG. Construct CFG for the following languages:

$$L = \left\{ a^n b^m c^m d^n \mid m, n > 0 \right\}.$$

    c) Construct the following CFG without Useless symbols if any. Justify your answer.

$$S \rightarrow AB \mid BC$$
$$A \rightarrow aAa \mid aAb$$
$$B \rightarrow bB \mid b$$
$$D \rightarrow dD \mid d$$

    d) Show that the language $L = \left\{ 0^n 1^n \mid n >= 1 \right\}$ is non regular.

Q.5 Attempt **ANY FOUR** of the following: [12]

    a) Define Mealy Machine with an example.

    b) Write regular expression for a language over {0, 1}, such that every string begin and end with either *aa* or *bb*.

    c) Define Parse tree and Ambiguous grammar.

    d) Write a note on Myphill–Nerode Theorem.

    e) Define Pumping Lemma for regular languages.

    f) Define unit production with example.

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