

Cluster Innovation Centre, University of Delhi, Delhi-110007

Examination : End Semester Examination – MAY 2024
Name of the Course : B. Tech (Information Technology and Mathematical Innovations)
Name of the Paper : Decoding Computation Structure and Logic
Paper Code : 32861602
Semester : VI
Duration : 2 Hours
Maximum Marks : 50

1. Attempt the following questions :

(2x10=20 Marks)

- Define Context Free Grammar.
- Construct a DFA which accepts a language of all binary strings divisible by 4.
- Write a regular expression for the set of all strings of 0's and 1's not containing 101 as substring.
- Write CFG to accept the language defined by, $L = \{a^i b^j c^k \mid i, j, k \geq 0 \text{ and } i=j+k\}$.
- Construct Finite Automata for the regular expression : $(a \mid b)^* abb$.
- Write a regular expression for even number of a's and odd number of b's of a string $w = \{a, b\}^*$.
- State and explain Pumping Lemma for CFG.
- Prove that Post's correspondence problem is undecidable.
- Does a pushdown automaton have memory? Justify. **Y/N?**
- Write about a Multi tape Turing machine.

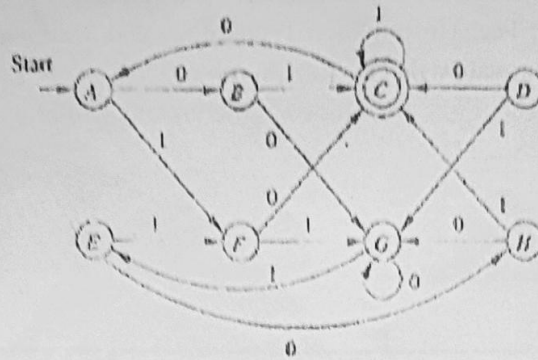
2. Attempt any two of the following questions :

(7.5x2=15 Marks)

- Prove that regular expressions are not closed under Infinite union and closed under Reversal.
- Design a pushdown automata to recognize the language, L defined by, $LL = \{w^c w^c \mid w \in \{0,1\}^* \text{ and } w^c \text{ is the one's complement of } w\}$.

Handwritten binary strings circled: 11000, 11100, 10000, 1000, 1000, 1100.

c. Minimize the following DFA



3. Attempt any two of the following questions :

(5x3=15 Marks)

a. What language over $\{0, 1\}$ does the CFG with productions

$S \rightarrow 00S \mid 11S \mid S00 \mid S11 \mid 01S01 \mid 01S10 \mid 10S10 \mid 10S01 \mid \epsilon$ will

generate? Justify your answer.

b. Construct an appropriate model to recognize the language L defined by, $L =$

$\{a^n b^m c^m d^n \mid n, m \geq 0\}$

c. What is the purpose of normalization? Construct the CNF and GNF for the following grammar and explain the steps.

$S \rightarrow aAa \mid bBb \mid \epsilon$

$A \rightarrow C \mid a$

$B \rightarrow C \mid b$

$C \rightarrow CDE \mid \epsilon$

$D \rightarrow A \mid B \mid ab$.