Duration: 3 hrs |Max Marks: 80]

N.B. : (1) Question No 1 is Compulsory.
     (2) Attempt any three questions out of the remaining five.
     (3) All questions carry equal marks.
     (4) Assume suitable data, if required and state it clearly.

1   [20]

   a   Differentiate Finite Automata, Push Down Automata and Turing Machine.

   b   Discuss different applications of Finite Automata

   c   Design DFA that accepts Strings with at least 3 a's. over $\sum=\{a,b\}$.

   d   Simplify the given grammar
             $S \to ASB \mid \epsilon$
             $A \to aAS \mid a$
             $B \to SbS \mid A \mid bb$

2 a   Compare and Contrast Moore and Mealy Machines. Design Moore machine for $\sum=\{0,1\}$,   [10]
      print the residue modulo 3 for binary numbers.

   b   Design Push Down Machine that accepts $L = \{a^m b^n c^n d^m \mid m, n>0\}$ [10]

3 a   i)   Construct CFG for given language. $L = \{0^i 1^j 0^k \mid j>i+k\}$ [10]
        ii)   The grammar G is $S \to aB \mid bA$ $A \to a \mid aS \mid bAA$ $B \to b \mid bS \mid aBB$
            Obtain parse tree for the following string "aababb" and check if the grammar is
            ambiguous.

   b   Explain Pumping Lemma with the help of a diagram to prove that given language is not a   [10]
      regular language. $L=\{0^m 1^{m+1} \mid m>0\}$

4 a   i) Design DFA that accepts Strings that ends in either "110" or "101" over $\sum=\{0,1\}$.   [10]
        ii) Design NFA that accepts strings starting with "abb" or "bba"

   b   Given NFA with epsilon, Find equivalent DFA. q1 is the initial state, q3 is final state   [10]

	0	1	2	ϵ
$\to$q1	{q1}	-	-	{q2}
q2	-	{q2}	-	{q3}
*q3	-	-	{q3}	-

5 a   Find Equivalent Greibach Normal Form (GNF) for given CFG.   [10]
            $S \to AA \mid a$
            $A \to SS \mid b$

   b   Define and design Turing Machine to accept $0^n 1^n 2^n$ over $\sum=\{0,1,2\}$.   [10]

6   Write Short notes (Any Two)   [20]

   a   Explain with example Chomsky Hierarchy.

   b   Post Correspondence Problem.

   c   Recursive and Recursive enumerable languages.

   d   TM-Halting Problem.

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