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IV-SEMESTER
END TERM EXAMINATION

Roll No.....
B.Tech.(CSE)
May– 2025

CS-204 THEORY OF COMPUTATION

Time: 3:00 Hours **Max. Marks: 50**

Note: Attempt **any five** questions. Assume suitable missing data, if any

Q.No. 1

A. Construct DFA that accepts string over {0, 1} if and only if the value of the strings interpreted as a binary representation of an integer is 0 mod 5. For example 0101, 1111 representing integer '5' and '15' respectively are to be accepted.

[5] CO1 BTL-3

B. What is pumping lemma for regular expression? Show that the language **L= {0^n | n is a Perfect Square}** is not regular.

[5] CO1 BTL-1,3

Q.No. 2

A. Design Moore and Mealy machine for binary input sequence if it ends in 1010, output is 'HELLO' if it ends in '1011' output is 'DELHI' , otherwise 'DTU'.

[5] CO3 BTL-3,4

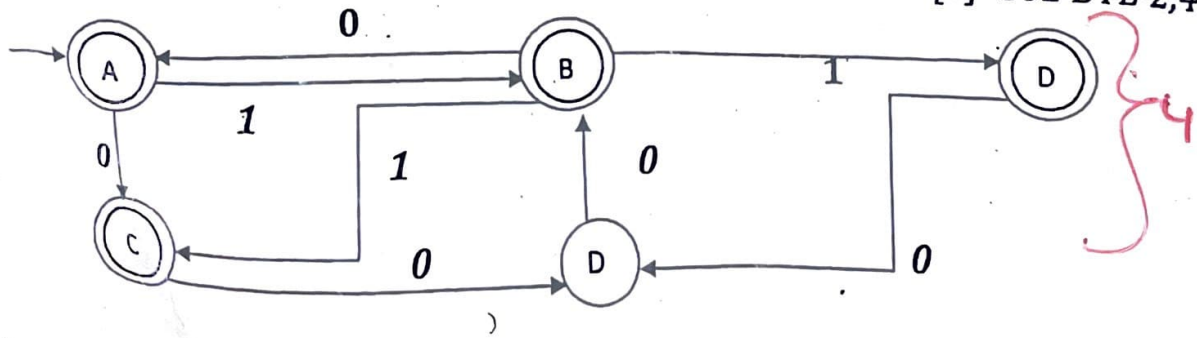
B. Construct a Context Free Grammar (CFG) for the alphabet {0,1} with number of 0's not equal to number of 1's and also explain chomsky's classification for the grammar.

[5] CO2 BTL-2,3

Q.No. 3

A. What is Arden's theorem? Find a regular expression (RE) corresponding to the following FA using Arden's theorem.

[5] CO2 BTL-2,4



B. Is it possible for every context-free grammar to be converted to both CNF and GNF? *[5] CO2 BTL-1,2*

i. Convert the following grammar to CNF
S → bA | aB , A → bAA | aS | a , B → aBB | bS | b

ii. Convert following CFG to GNF
S → AB, A → BS | b, B → SA | a

Q.No. 4

A. Explain equivalence of two finite Automata (FA) and Construct a DFA to recognize the regular expression **(a+b(b+ab)*aa)*.** *[5] CO1 BTL-2,3*

B. Construct a push down automata for the following Language **L= { $a^n b^{n+2}$ | n=1, 2, 3,.....}.** *[5] CO4 BTL-5*

Q.No. 5

A. What is pumping lemma for context free language? Prove that the language **L= { $a^n b^n c^n$ | n≥0}** is not CFL using pumping lemma for context free language (CFL). *[5] CO3 BTL-3*

B. Why the Universal Turing Machine (UTM) concept is important in the theory of computation? Design a Turing Machine (TM) that accepts all palindromes over the input alphabet {0,1}. *[5] CO5 BTL-4,5*

Q.No. 6

A. Construct the CFG generating the language accepted by the following PDA: M=({ q_0,q_1}, {0,1},{Z_0,X},δ,q_0, Z_0,ϕ) where δ is given below: *[5] CO4 BTL-5*

$\delta(q_0, 1, Z_0) = \{(q_0, X Z_0)\}$
$\delta(q_0, 1, X) = \{(q_0, X X)\}$
$\delta(q_0, 0, X) = \{(q_1, X)\}$
$\delta(q_0, €, Z_0) = \{(q_0, €)\}$
$\delta(q_1, 1, X) = \{(q_1, €)\}$
$\delta(q_1, 0, Z_0) = \{(q_0, Z_0)\}$

B. Explain following with suitable example

i. Halting problem and Church's thesis. *[2.5] CO5 BTL-1,2*

ii. Post Correspondence Problem (PCP) and Myhill-Nerode Theorem. *[2.5] CO4 BTL-1,2*