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**Question Paper Code: U5E02**

B.E./B.Tech. DEGREE EXAMINATION, NOV 2023

Fifth Semester

Artificial Intelligence & Data Science

**21UAD502 - FORMAL LANGUAGE AND COMPUTATION**

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

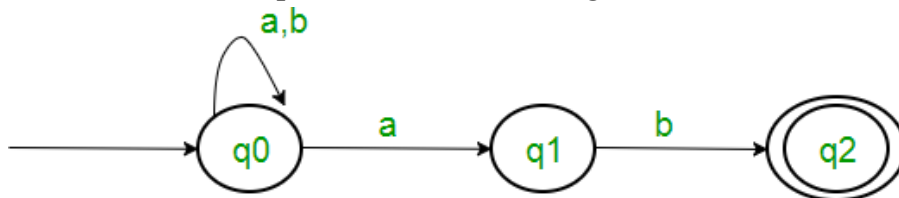
Answer All Questions

PART A - (10 x 2 = 20 Marks)

1. Construct finite automata for the language  $\{0^n | n \bmod 3 = 2, n \geq 0\}$  CO2-App
2. Construct DFA over  $\Sigma = (a, b)$  which produces not more than 3a's. CO2-App
3. Find out the language generated by the RE  $= (0+1)^*$ . CO2-App
4. Show whether a language  $L = \{0^n 1 2^n | n > 0\}$  is regular or not using pumping lemma CO2-App
5. Define the pumping Lemma for CFL. CO1-U
6. What are the ways of language acceptance in PDA? CO1-U
7. What are the two normal forms of CFG? Write their productions format? CO1-U
8. Draw a transition diagram for a Turing machine to identify  $n \bmod 2$ . CO1-U
9. Define a universal language  $L_u$ . CO1-U
10. Illustrate on Primitive Recursive Function. CO1-U

PART – B (5 x 16 = 80 Marks)

11. (a) Construct DFA equivalent to the NFA given below. CO2-App (16)



Or

- (b) (i) Analyze and prove that if  $n$  is a positive integer such that  $n \bmod 4$  is 2 or 3 then  $n$  is not a perfect square. CO2- App (8)
- (ii) Construct a DFA that accept the string  $\{0,1\}$  that always sends with 00 (8)
12. (a) Demonstrate how these  $L = \{a^n b^n / n \geq 0\}$  is not a regular. CO2- App (16)
- Or
- (b) State and prove any two closure properties of Regular Languages. CO2- App (16)
13. (a) (i) Identify CFG for the language  $L = \{0^i 1^j 0^k | j > i+k\}$ . CO2- App (8)
- (ii) Illustrate a PDA for the language  $\{WCWR / W \in \{0,1\}^*\}$ . (8)
- Or
- (b) (i) Describe the PDA that accept the given CO2- App (8)
- $CFGs \rightarrow xaax \ \& \ X \rightarrow ax/bx/\epsilon$
- (ii) Express a PDA for the language  $a^n b^m a^{n+m}$  (8)
14. (a) Explain how a multitrack in a TM can be used for testing given positive integer is a prime or not. CO2- App (16)
- Or
- (b) Prepare a subroutine to move a TM head from its current position to the right, skipping over all 0's until reaching a 1 or a blank. If the current position does not hold 0, then the TM should halt. You may assume that there are no tape symbol other than 0,1 and B(blank). Then, use this subroutine to design to TM that accepts all strings of 0's and 1's that do not have two 1's in a row. CO2- App (16)
15. (a) (i) Explain about the recursively Enumerable Language with example. CO1-U (8)
- (ii) Point out that the following problem is un decidable. Given Two CFGs  $G_1$  and  $G_2$  is  $L(G_1)L(G_2) = \emptyset$ . (8)
- Or
- (b) (i) Point out the Measuring and Classifying Complexity. CO1- U (8)
- (ii) Does PCP with two lists  $x = (b, bab^3, ba)$  and  $y = (b^3, ba, a)$  Have a solution. (8)