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Question Paper Code: U5E02

B.E./B.Tech. DEGREE EXAMINATION, APRIL 2024

Fifth Semester

Artificial Intelligence & Data Science

21UAD502 - FORMAL LANGUAGE AND COMPUTATION

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

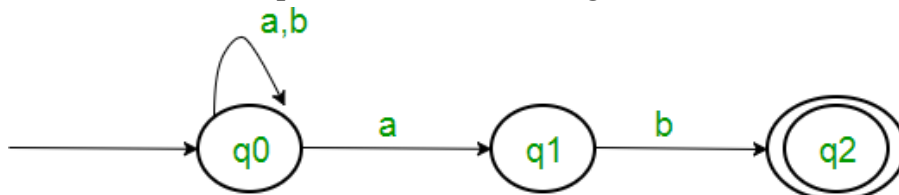
Answer All Questions

PART A - (10 x 2 = 20 Marks)

1. Define Deterministic Finite Automaton. 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 $L=(0^n1^2n|n>0)$ 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. When do you say Turing machine is an algorithm. CO1-U

PART – B (5 x 16= 80 Marks)

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



Or

- (b) Given $\Sigma = \{a,b\}$ Analyze and construct a DFA which recognize the language $L = \{b^m a b^n : m, n > 0\}$ CO2- App (16)
12. (a) Explain the DFA Minimization algorithm with an Example. CO2- App (16)
Or
- (b) State and prove any two closure properties of Regular Languages. CO2- App (16)
13. (a) Construct the grammar for the following PDAM. CO2- App (16)
 $M = (\{q_0, q_1\}, \{0, 1\}, \{X, z_0\}, \delta, q_0, Z_0, \Phi)$ and
Where δ is given by
- $$\begin{aligned} \delta(q_0, 1, z_0) &= \{(q_0, XZ_0)\}, \\ \delta(q_0, 1, X) &= \{(q_0, XX)\}, \\ \delta(q_0, 0, X) &= \{(q_1, X)\}, \\ \delta(q_0, \epsilon, Z_0) &= \{(q_0, \epsilon)\}, \\ \delta(q_1, 1, X) &= \{(q_1, \epsilon)\}, \\ \delta(q_1, 0, Z_0) &= \{(q_0, Z_0)\}. \end{aligned}$$
- 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 CO2- App (16)
positive integer is a prime or not.
Or
- (b) Prepare a subroutine to move a TM head from its current position CO2- App (16)
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.
15. (a) Prove that Universal language is recursively enumerable but not CO1-U (16)
recursive.
Or
- (b) Define PCP and prove that PCP is undecidable. CO1- U (16)