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B. M. S. College of Engineering, Bengaluru - 560019

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E. **Semester: III**
Branch: Artificial Intelligence and Machine Learning **Duration: 3 hrs.**
Course Code: 20AM3PCTFC **Max Marks: 100**
Course: Theoretical Foundations of Computations **Date: 15.09.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may suitably assumed.

UNIT - I

1. a) Construct deterministic automata to accept some number of a's followed by some number of b's with the total length of the string being odd. **8**

   b) Bring out the differences between DFA, NFA and ϵ- NFA **4**

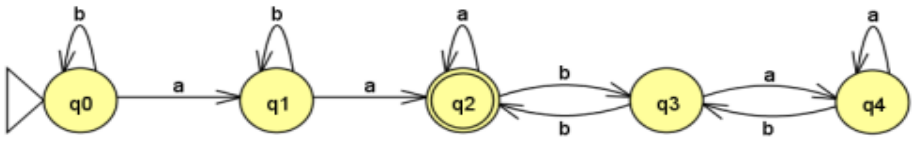
   c) Construct a Non-deterministic Finite Automaton (NFA) for Binary strings that begin with 11 and end with 11 or begin with 00 and end with 00. **8**

OR

2. a) Define the following with proper examples: **8**

   i. Symbols
   ii. Alphabet
   iii. Strings
   iv. Languages

   b) Analyze the given automata and define the language accepted . **4**



   c) Construct a finite automaton for **8**

   i. Binary strings in which every 0 is followed by 11.
   ii. Strings containing at least one a and at least one b.

UNIT - II

3. a) Write the equivalent regular expression for the following languages: **10**

   i) $L = \{ a^n b^m | \ m+n \text{ is even}\}$
   ii) $L = \{ a^n b^m \ | \ m>=1, n>=1, nm>=3 \}$
   iii) $L = \{w: |w| \bmod 3=0 \text{ where } w \epsilon (a+b)^*\}$
   iv) $L=\{w: n_a(w) \bmod 3=0 \text{ where } w \epsilon (a+b)^*\}$

   b) Prove that the following languages are not regular. **10**

   i. $L= \{a^n b^l \mid n!= l\}$
   ii. $L= \{ a^{n!} \mid n>=0\}$

UNIT - III

4. a) Generate grammar for the following language: **8**
   $L= L_1L_2$ where,
   $L_1= \{ a^n b^m / \ n >=0, m>n \}$
   $L_2= \{ 0^n 1^{2n} / \ n>=0\}$

   b) Analyse and check the given grammar for ambiguity of the expression id+id*id **6**

   E→ E+E | E-E | E*E | E/E | (E) |I
   I→id

   c) Eliminate all unit productions from the grammar given below: **6**
   S→AB A→a B→ C/ b
   C→D D→ E / bC E→ d/ Ab

UNIT - IV

5. a) Show that the language L= {w/ w = (a, b, c)*} where $n_a(w)= n_b(w)=n_c(w)$ } is not in CFL. **10**

   b) Convert the following grammar into Chomsky Normal Form. **10**
   S→ 0A/ 1B
   A→0AA/ 1S/ 1
   B → 1BB/ 0S/ 0

OR

6. a) Construct PDA to accept the language **10**
   $L(M) =\{w/w =(a,b)^* \text{ and } n_a(w)= n_b(w) \}$ by final state.

   b) Analyse the language given below and construct PDA for the same. Justify whether it is Deterministic or Non deterministic. **10**
   $L= \{ww^R / \ w =(a,b)^*\}$

UNIT - V

7. a) Apply the concepts of Turing machine and construct the same for the language L= (ab + ba)(a+b)*(ba+ab) **12**

   b) Write a note on : **8**

   i. Recursive language
   ii. Post correspondence Problem

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