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

Autonomous Institute Affiliated to VTU

August 2024 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

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)	Define Alphabet, String, Language and Power of an alphabet with example.	**4**
	b)	Define DFA and NFA with an example.	**8**
	c)	Show that "A Language L is accepted by some ∈–NFA if and only if L is accepted by some DFA".	**8**

OR

2.	a)	Construct a DFA to accept the following languages i.L = {w ∈ w is of even length and begins with 01} ii. L = {w ∈ w is a set of all strings consists of 1101 as a substring}	**10**
	b)	Construct a NFA to accept the following languages i. L = {w ∈ {a,b,c,d,l}* : w has at least one occurrence of lab, cab, and dab} ii. L = {w accepts decimal numbers}	**10**

UNIT - II

3.	a)	Design REs for the following languages over {0,1} i. The set of all strings that begin with 110. ii. The set of all strings that contain 1011. iii. The set of all strings that contain exactly three 1's	**6**
	b)	Design NFA with ∈– transitions for the following REs i. 011(0+1)* ii. (0+1)*1 (0+1)	**6**
	c)	State and prove pumping lemma for regular languages.	**8**

UNIT - III

4. a) Define ambiguous and unambiguous grammar. **6**
Show that the following grammar is ambiguous by considering the string aabbccdd.
$S \rightarrow AB \mid C$
$A \rightarrow aAb \mid ab$
$B \rightarrow cBd \mid cd$
$C \rightarrow aCd \mid aDd$
$D \rightarrow bDc \mid bc$

b) Explain the applications of CFG. **4**

c) Eliminate Useless Symbols, Epsilon productions and Unit productions from the following grammar. **10**
$S \rightarrow aACa$
$A \rightarrow B \mid a$
$B \rightarrow C \mid c$
$C \rightarrow cC \mid \in$

UNIT - IV

5. a) Define CNF. Convert the following grammar to CNF. **6**
$E \rightarrow E + T \mid T * F \mid (E) \mid a \mid b \mid Ia \mid Ib \mid I0 \mid I1$
$T \rightarrow T * F \mid (E) \mid a \mid b \mid Ia \mid Ib \mid I0 \mid I1$
$F \rightarrow (E) \mid a \mid b \mid Ia \mid Ib \mid I0 \mid I1$
$I \rightarrow a \mid b \mid Ia \mid Ib \mid I0 \mid I1$

b) Define GNF. Convert the following grammar to GNF. **8**
$S \rightarrow AA \mid 0$
$A \rightarrow SS \mid 1$

c) State the pumping lemma for CFLs. **6**
Show that the following language is not CFL.
$L = \{x \in \{0,1\}^* \mid |x| \text{ is a perfect square}\}$

OR

6. a) Define PDA. Construct PDA for the following language. **10**
$L = \{a^n b^n \mid n \geq 1\}$ and
Show the sequence of moves made by the PDA for the string aaabbb.

b) Define Deterministic PDA. **10**
Construct PDA for the following language.
$L = \{wcw^R \mid w \in \{a+b\}^*\}$
Examine whether the PDA is deterministic are not.

UNIT - V

7. a) Design PDA from the following grammar **10**
$I \rightarrow a \mid b \mid Ia \mid Ib \mid I1 \mid I0$
$E \rightarrow I \mid E * E \mid E + E \mid (E)$

b) Define TM. Construct a TM which accepts the set of all palindromes over {a,b}. **10**

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