BACHELOR OF TECHNOLOGY (CBCS) (2021-COURSE)
B. Tech. Sem - IV Computer Science & Engineering-AI & ML : WINTER : 2024
SUBJECT: THEORY OF COMPUTATION

Day : Saturday
Date : 30/11/2024

W-23946-2024

Time : 02:30 PM-05:30 PM
Max. Marks : 60

N.B. 1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Draw neat diagrams wherever necessary.

Q. 1 Design a DFA – **(10)**

i) $L=\{x\in\{a,b,c,\}^*:|\,X\,|\,a=0 \bmod 3\}$

ii) $L=\{x\in\{0,1\}^*:|\,\text{sec}\,ond\ symbol\ of\ is\ 0\ and\ \ fourth\ is\ 0\ and\ fourth\ is\ 1\}$

OR

Q.1 If language L is accepted by NFA then there exits an equivalent DFA that accepts the same language. Explain with example **(10)**

Q. 2 Construct NFA for following RE **(10)**

a) 01* + 1
b) ab* +b
c) ((a+bb)*aa)*
d) (0(00)*1+01*0)*
e) 10+(0+11)0*1
f) ab*aa+bba*ab

OR

Q.2 Find finite Automata without epsilon transition for given regular expression **(10)**

a) $r=10+(0+11)0^*1$

b) $r=(0+1)^*(00+11)(0+1)^*$

c) $r=(ab)^*ba^*(bb+ab)^*$

Q.3 What is ambiguity in grammar show the following grammar is ambiguous or not, justify your answer **(10)**

$S\rightarrow S+S\,|\,S^*S\,|\,a\,|\,b\,|\,c$

OR

Q.3 Convert the following grammar into Greibach normal form (GNF) **(10)**

$S\rightarrow AB$

$A\rightarrow BSB\,|\,BB\,|\,b$

$B\rightarrow aAb\,|\,a$

Q. 4 Design a PDA to accept each of the following languages by final state **(10)**

a) $\{0^n\,1^n\,|\,n>=1\}$

b) The set of all strings of 0's and 1's with an equal number of 0's and 1's

OR

Q.4 Demonstrate the languages defined by PDA's are exactly the context-free languages. **(10)**

Q. 5 Explain a Turing machine with two way infinite tape and write a relation with one way infinite tape **(10)**

OR

Q.5 Design a Turing machine that accepts **(10)**

$L=\{a^n\,b^n\,|\,n\geq 1\}$

Q. 6 Prove the following **(10)**

a) the complement of a recursive language is recursive
b) the union of two recursive language is recursive

OR

Q.6 Explain the Halting problem with suitable example **(10)**

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