TE/comp/sem-I/CBCGS/R-19/c-scheme/TCS/SH-2024 11/11/2024 Lib

(3 hours) [80 marks]

NOTE:

1. **Question No 1 is compulsory.**
2. **Attempt any three questions from remaining.**
3. **Assume suitable data if necessary and state the same.**

QP-10067276

Q1 Solve all questions below 20

a) Design a Mealy Machine to identify if string starts with prefix ab over {a,b}*.

b) Construct a DFA for accepting all strings over {a,b} with substring abb.

c) Explain Universal Turing Machine.

d) Compare DFA and PDA

Q2

a) Find regular expression (RE) for all strings starting with b and ending in ba over {a,b}. Design NFA with epsilon moves for this RE. Convert it to equivalent DFA. 10

b) Find the Context Free Grammar for following 10
i. $L = \{a^i b^j c^k \mid i = j+k\}$ ii. $L = \{x \in \{0,1\} \mid x$ has equal number of zeros and ones $\}$

Q3

a) Convert following grammar to Chomky Normal Form 10
$S \rightarrow AACD$, $A \rightarrow aAb \mid \varepsilon$, $C \rightarrow aC \mid a$, $D \rightarrow aDa \mid bDb \mid \varepsilon$.

b) State closure properties of Regular languages and Context Free Languages. 10

Q4

a) Design PDA for $\{a^n x^n \mid n >= 0, x \in \{b\}^*\}$. Comment if it is deterministic or not. 10

b) Find minimum state Finite Automata accepting (01*0 + 10*). First deign a NFA with epsilon moves. 10

Q5

a) State pumping lemma for context-free-languages. Apply pumping lemma to $L = \{ss \mid s \in \{a,b\}^*\}$. 10

b) Design a Turing Machine to add two unary numbers. Show simulation of the machine 10

Q6 Write Detailed note on (Any two) 20

a) Applications of FA, PDA and TM.

b) Types of Turning Machines.

c) Chomsky Hierarchy.

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