U.S.N.										

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

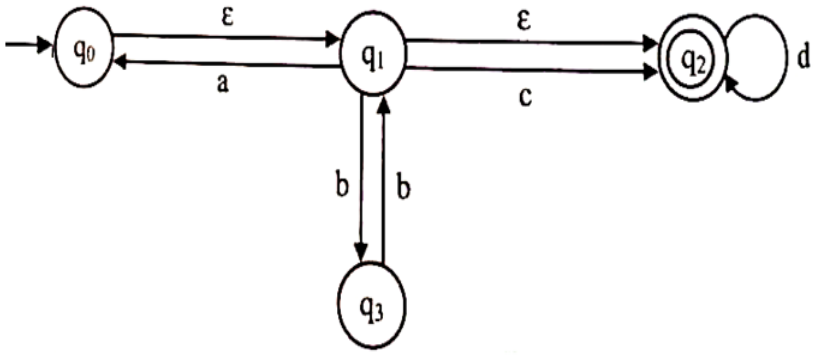
Autonomous Institute Affiliated to VTU

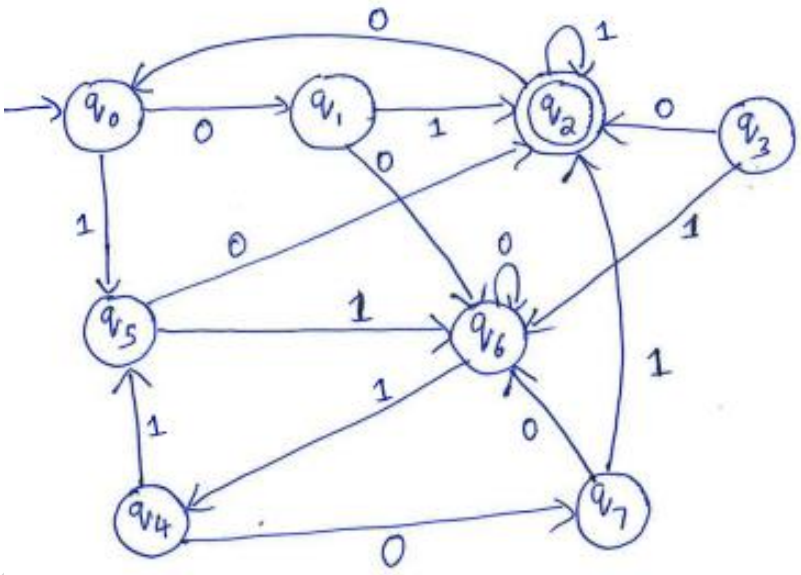
October 2024 Supplementary Examinations

Programme: B.E. **Semester: IV**
Branch: Computer Science and Engineering **Duration: 3 hrs.**
Course Code: 23CS4PCTFC **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 be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	CO	PO	Marks
1	a)	(i) Design Deterministic Finite Automata (DFA) which accepts set of strings such that every string containing 00 as a substring but not 000 as substring. Consider alphabet set as Σ ={0, 1}. (ii) Design NFA for the language L= {all strings over (0,1)* that have at least two consecutive 0's or two consecutive 1's }	CO1	PO1	5
	b)	Convert the following Non-Deterministic Finite Automata (NFA) with Epsilon (ε)-transitions to equivalent NFA without Epsilon -transitions by giving the epsilon closure of all the states. 	CO 1	PO 1	8
	c)	Construct NFA which accepts set of all strings whose second last symbol is 1. Convert this NFA to DFA using Subset Construction Method. Consider alphabet set as Σ ={0, 1}.	CO 1	PO 1	7
		OR			
2	a)	(i) Design DFA to accept strings of a's and b's ending with ab or ba (ii) Design a DFA to accept the language L={w | number of a's in (w) >=1, number of b's in (w) >=2}	CO 1	PO 1	5

		b)	Convert the following NFA to DFA using Subset Construction Method. δ | 0 | 1 → Q0 | Q0, Q1 | Q1 * Q1 | Q2 | Q2 Q2 | ∅ | Q2	***CO 1***	***PO 1***	**8**
		c)	Convert the following ε-NFA to DFA. δ | ε | a | b | c → P | ∅ | P | Q | R Q | P | Q | R | ∅ * R | Q | R | ∅ | P	***CO 1***	***PO 1***	**7**
			UNIT-II			
	3	a)	Construct the minimum state automata for the finite automata given below. Consider alphabet set as Σ ={0 , 1}.  	***CO 2***	***PO 2***	**10**
		b)	Convert the DFA which accepts Even number of 1's to Regular Expression (RE) by eliminating intermediate states method. Consider alphabet set as Σ ={0, 1}.	***CO 2***	***PO 2***	**10**
			UNIT - III			
	4	a)	Convert the following Grammar to Chomsky Normal Form (CNF) S → abAB , A → Bab | ε , B → Baa | A | ε	***CO 2***	***PO 2***	**10**
		b)	Design a Context Free Grammar (CFG) for L= { $a^n c^m b^k$ | n=m or m<=k , for n, m, k >=0 }. Write formal definition of the obtained CFG.	***CO 2***	***PO 2***	**10**

			OR			
	5	a)	Convert the following Grammar to Chomsky Normal Form (CNF) $S \rightarrow AB \mid aB$, $A \rightarrow aab \mid \varepsilon$, $B \rightarrow bbA$	***CO 2***	***PO 2***	**10**
		b)	Design a CFG for the language that generates the set of (i) All strings with exactly one a (ii) All strings with at least one a (iii) All strings with at least three a's Consider alphabet set as $\Sigma = \{a, b\}$.	***CO 2***	***PO 2***	**10**
			UNIT - IV			
	6	a)	i. Construct a Non-Deterministic Push Down Automata (NPDA) for accepting all palindromes over the alphabet set $\Sigma = \{a, b\}$ ii. Design Deterministic Push Down Automata (DPDA) for the language $L = \{ a^n b^{2n} \mid n>=1\}$	***CO 3***	***PO 3***	**8**
		b)	Construct PDA that accepts the language generated by the grammar $S \rightarrow aSbb \mid abb$	***CO 3***	***PO 3***	**6**
		c)	Prove that the language $L = \{ a^n b^n c^n, n \geq 1 \}$ is not Context Free Language (CFL)	***CO 3***	***PO 3***	**6**
			UNIT - V			
	7	a)	Design a Turing Machine (TM) for set of string with equal number of 0's and 1's over $\{0, 1\}^*$	***CO 3***	***PO 3***	**10**
		b)	Determine whether the following (A, B) pairs have a Post Correspondence solution or not, if Yes give solution, if No why, Justify. (i) $A = \{b, babb, ba\}$ $B = \{bb, ba, ba\}$ (ii) $A = \{1^2, 10^2, 1^3\}$ $B = \{1^3, 0^2 1, 1^2\}$	***CO 3***	***PO 3***	**10**

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