U.S.N.										

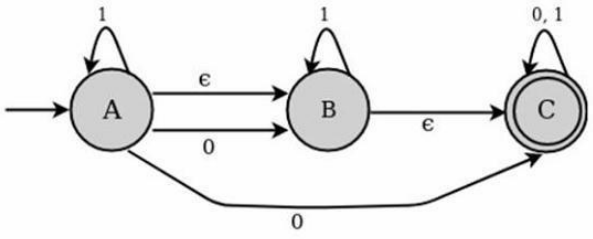
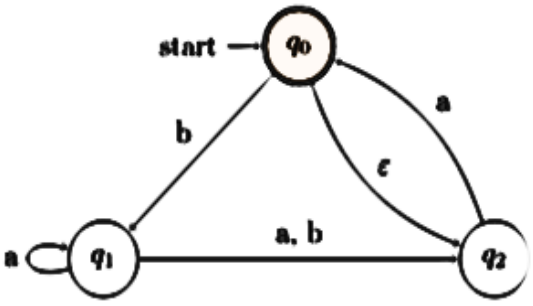
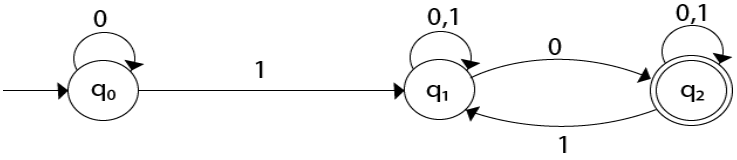
B.M.S. College of Engineering, Bengaluru-560019

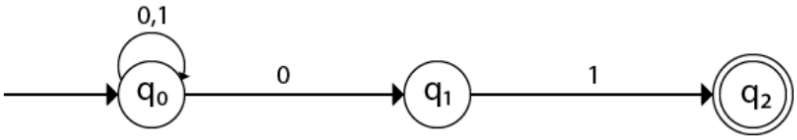
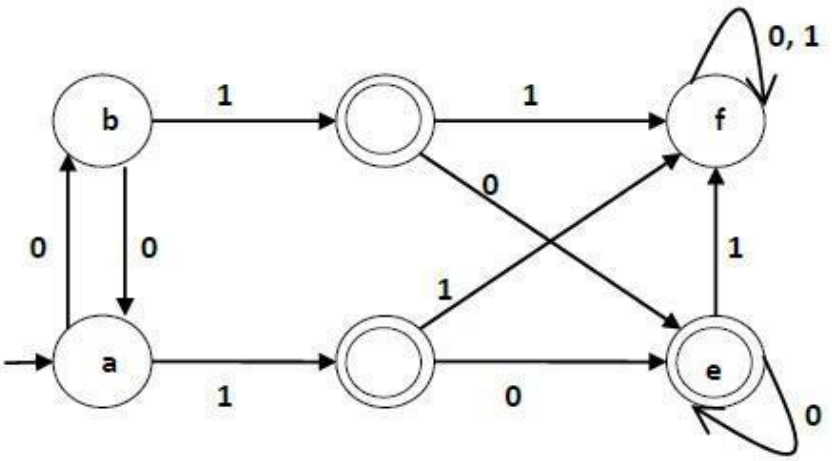
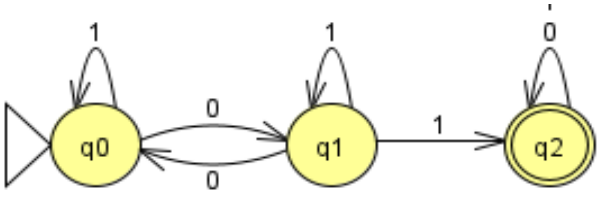
Autonomous Institute Affiliated to VTU

December 2023 Supplementary Examinations

Programme: B.E. **Semester: IV**
Branch: Information Science and Engineering **Duration: 3 hrs.**
Course Code: 22IS4PCTFC **Max Marks: 100**
Course: Theoretical Foundations of Computation

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

		UNIT - I	*CO*	*PO*	Marks
1	a)	Construct DFA for the following Languages: i.) $L = \{w \mid w \in \{a,b\}^* \text{ and } n_a(w) \bmod 3 = n_b(w) \bmod 3\}$ ii.) L= { 1w0 | w is the set of strings with 0's and 1's} iii.) L = { w | w is the set of binary strings divisible by 5 }	CO3	PO3	**10**
	b)	Define E-closure and write E-Closures for all states in the ε-NFA given below: 	CO1	PO1	**05**
	c)	Obtain equivalent DFA for the following ε-NFA. 	CO2	PO2	**05**
		OR			
2	a)	Obtain equivalent DFA for the given NFA. 	CO1	PO1	**07**

		b)	Identify the language accepted by the following NFA. List any 5 strings accepted by the following NFA. 	CO2	PO2	**04**
		c)	Minimize the given DFA using Table Filling Method. 	CO1	PO1	**09**
			UNIT - II			
3		a)	Obtain Finite Automata for the following regular expressions. i. (0+1)*(00+10+11) ii. (a+b)*ab + ba(a+b)* iii. (a+b)*aa(a+b)*	CO2	PO2	**06**
		b)	Prove that the given Language is not regular. L = { $a^n b^n$ | where n >= 1}	CO1	PO1	**06**
		c)	Compose regular expressions for the following languages: (i) Set of all strings of a's and b's of odd length. (ii) L={vwv | w and v ∈ {a,b}* and |v|=2. (iii) Set of strings that do not end with 01 over {0,1}* (iv) Accept strings with two or more letters but beginning and ending with same letter, $\Sigma = \{0,1\}$	CO2	PO2	**08**
			OR			
4		a)	Provide English description to identify the language for the following: (i) (a+b)*(aa+bb) (ii) (ε+a+b) (ε+a+b) (ε+a+b) (iii) 0(10+0)*1	CO2	PO2	**06**
		b)	Obtain regular expression for the following FA using state elimination method. 	CO2	PO2	**06**

		c)	State and prove pumping lemma theorem for regular Languages. Using the same, prove that the language L={1^n | n is a prime number} is not regular.	CO1	PO1	**08**
			UNIT III			
	5	a)	Convert the given Grammar to CNF: S → ABC | BaB A → aA | BaC |aaa B → bBb | a |D C → CA |AC D →ε	CO1	PO1	**10**
		b)	Derive Context Free Grammar for the following languages: i.) L (G) = {$a^m b^n$ | m ≥ 0 and n > 0} ii.) L(G) = {w | w ∈ {0, 1, 2}∗ and is a palindrome}	CO3	PO3	**04**
		c)	Determine if the following grammar is ambiguous or not. Provide leftmost and rightmost derivations for the string "aabbba". Write corresponding parse trees. S → AS | ε A → aa | ab | ba | bb	CO2	PO2	**06**
			UNIT - IV			
	6	a)	Write the necessary conditions with suitable examples to determine if the PDA is deterministic or non-deterministic.	CO1	PO1	**04**
		b)	Design a PDA to accept the language L = {$a^{m+n}b^mc^n$ | m and n are ≥1} by final state. Write the sequence of moves using instantaneous description for acceptance of any string.	CO3	PO3	**10**
		c)	Convert the following grammar to PDA. S → aABC A → aB | a B → bA | b C → a	CO2	PO2	**06**
			UNIT - V			
	7	a)	Design Turing Machine to accept the language L= {$0^n1^n2^n$ | n>=1}.	CO3	PO3	**10**
		b)	Construct a Turing machine to accept the Language of aba over ∑ = {a, b}.	CO3	PO3	**05**
		c)	Is it possible for a Turing machine to recognize any language? Justify your answer.	CO2	PO2	**05**

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