U.S.N.										

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

Autonomous Institute Affiliated to VTU

September / October 2023 Semester End Main Examinations

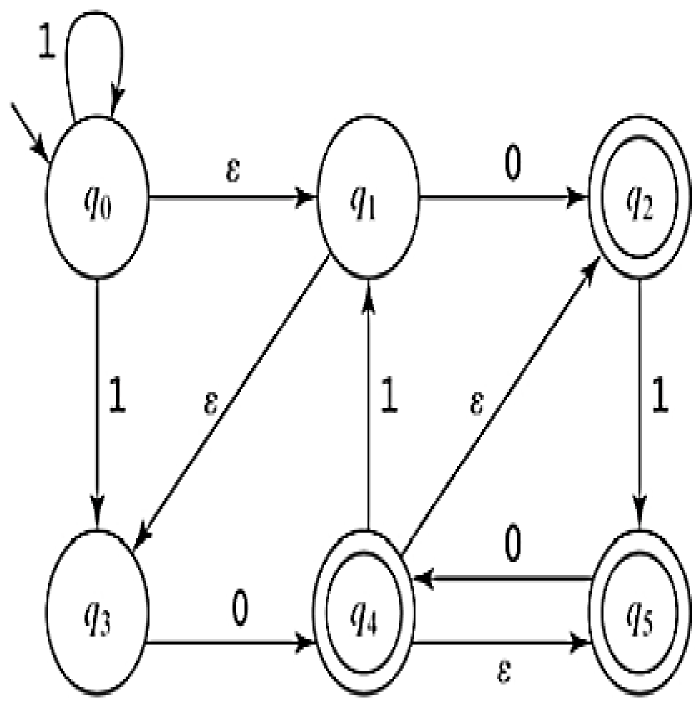
Programme: B.E.
Branch: Computer Science & Engineering
Course Code: 22CS4PCTFC
Course: Theoretical Foundations of Computations

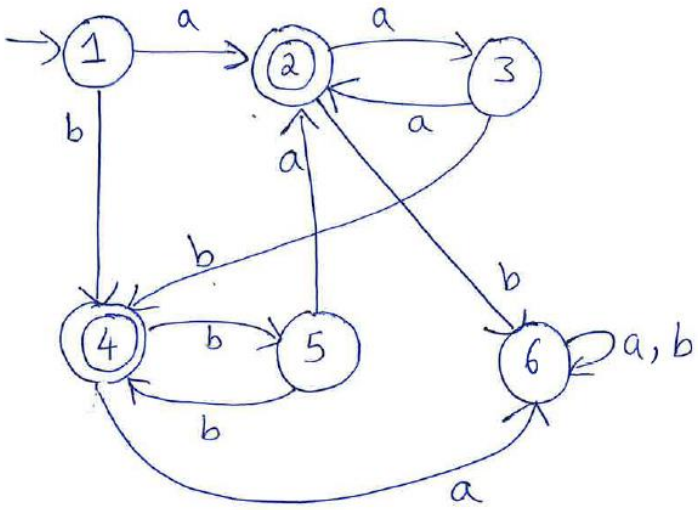
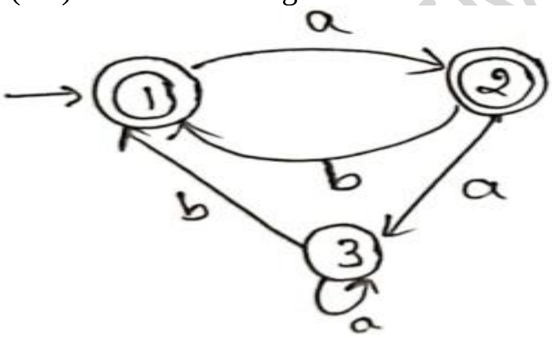
Semester: IV
Duration: 3 hrs.
Max Marks: 100

Instructions: 1. Answer FIVE full questions
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)	Construct NFA (Non-deterministic Finite Automata) for the following, i. The language { w ∈ (0+1)* | w ends with 00 } ii. The language { w ∈ (0+1)* | w contains the substring 0101}	*CO1*	*PO1*	**6**
	b)	Design a DFA (Deterministic Finite Automata) for each of the following languages. i) L = {w ∈ {0, 1}* | w does not have 001 as a substring}. ii) L={w | $n_a(w)$ are odd and $n_b(w)$ are even}	*CO3*	*PO3*	**6**
	c)	Construct DFA for the following ε -NFA	*CO1*	*PO1*	**8**



			UNIT - II			
	2	a)	Minimize the following DFA 	*CO1*	*PO1*	**10**
		b)	Apply state elimination method to construct a Regular Expression (RE) for the following Finite state machine 	*CO1*	*PO1*	**6**
		c)	Apply Pumping Lemma theorem to show that the language, L= $\{ww^R \mid w \in \{0,1\}^*\}$ is not regular	*CO1*	*PO1*	**4**
			OR			
	3	a)	Prove that the regular languages are closed under complement, intersection and difference.	*CO2*	*PO2*	**8**
		b)	Write regular expressions for the following languages i) $L = \{a^n b^m \mid m \geq 1, n \geq 1, mn \geq 3\}$. ii) L= {w ϵ {0, 1}* , w has 001 as a substring} iii) L = {w ϵ {0, 1}* , |w| mod 3 == 0 }	*CO1*	*PO1*	**6**
		c)	State the applications of Regular Expressions.	*CO1*	*PO1*	**6**
			UNIT - III			
	4	a)	Construct Context Free Grammar (CFG) for the following languages i) $L = \{0^{2n}1^m \mid m, n \geq 0\}$ ii) $L = \{0^i 1^j 2^k \mid i=j \text{ or } j=k\}$	*CO3*	*PO3*	**6**

		b)	Check whether the given grammar is ambiguous or not for the string w=**ibtibtaea** $S \rightarrow iCtS \mid iCtSeS \mid a$ $C \rightarrow b$	*CO2*	*PO2*	**6**
		c)	Simplify the grammar by removing useless symbols **S→ AS | CD | SB | A** **A → aA | a** **B→ bB |bC** **C→ cB** **D→ dD | d**	*CO2*	*PO2*	**8**
			OR			
	5	a)	Convert the following grammar to Chomsky Normal Form (CNF). **S -> ABC** **A -> aC | D** **B -> bB | ε | A** **C -> Ac | ε | Cc** **D -> aa**	*CO2*	*PO2*	**12**
		b)	Simplify the grammar by removing useless symbols **S →aAa** **A → Sb | bCC | DaA** **C→abb | DD** **D →aDa** **E →aC**	*CO2*	*PO2*	**8**
			UNIT - IV			
	6	a)	Construct a Push Down Automat (PDA) to accept the language $L(M) = \{wCw^R \mid w \in (a+b)^*\}$, where W^R is reverse of W by a final state method	*CO3*	*PO3*	**8**
		b)	For the grammar: $S \rightarrow aABB \mid aAA$ $A \rightarrow aBB \mid a$ $B \rightarrow bBB \mid b$ $C \rightarrow b$ Obtain the corresponding PDA	*CO2*	*PO2*	**6**
		c)	Show that the language $L=\{a^nb^nc^n \mid n >= 1\}$ is not Context Free Language using Pumping Lemma theorem.	*CO2*	*PO2*	**6**
			UNIT - V			
	7	a)	Construct Turing Machine (TM) for $L=\{0^n1^n \; n>=1\}$. Show that the string 0011 is accepted	*CO2*	*PO2*	**8**
		b)	Explain Post Correspondence (PCP), and show that the PCP with list x=(0, 01000, 01) and y=(000, 01, 1) have a solution.	*CO2*	*PO2*	**6**
		c)	Explain different types of Turing Machine’s (TM)	*CO1*	*PO1*	**6**

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