U.S.N.										

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

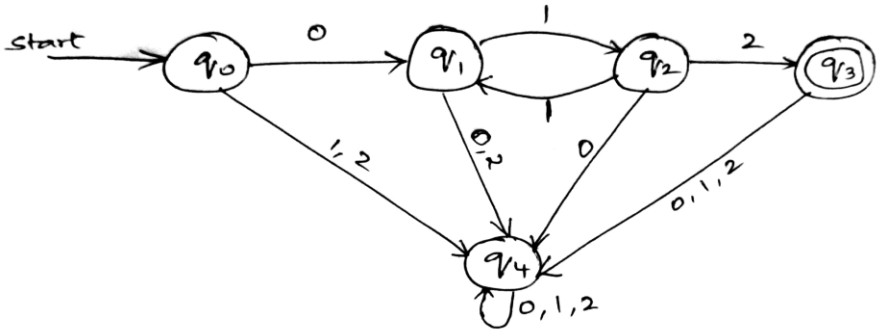
Autonomous Institute Affiliated to VTU

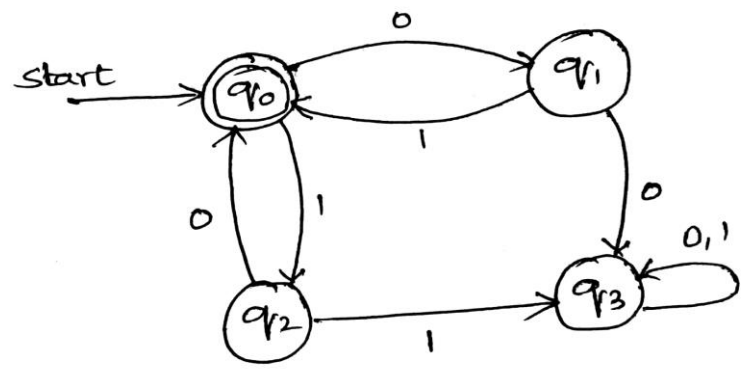
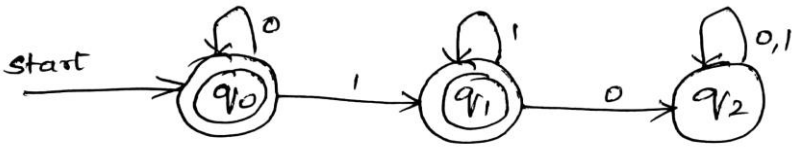
February 2025 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: Computer Science and Engineering **Duration: 3 hrs.**
Course Code: 22CS4PCTFC **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)	Define Finite Automata. Demonstrate the same using an ON/OFF Switch.	*1*	*1*	**5**
	b)	Analyze the given DFA. Draw the transition table and write the language equivalent. Explain. 	*1*	*2*	**7**
	c)	Obtain an ε-NFA which accepts strings consisting of zero or more **a**'s followed by zero or more **b**'s followed by zero or more **c**'s.	*1*	*3*	**8**
		OR			
2	a)	Design DFA for accepting binary strings that i)start with 00 ii)having 001 iii) ending with 01 iv) not having 111 v)whose value is multiple of 2	*3*	*3*	**10**
	b)	Design NFA for accepting strings that have 1 in second last position. Convert the same to DFA.	*1, 3*	*1,3*	**10**
		UNIT - II			
3	a)	List the notations used to represent regular expressions. Demonstrate the same with an example.	*1*	*1*	**6**

		b)	Analyze the given Finite Automata (FA) and obtain the corresponding regular expression. i.  ii.  	*1*	*2*	**6**
		c)	Obtain an Non- Deterministic Finite Automata (NFA) for the regular expression (a+b)*aa(a+b)*. Show the step by step procedure involved in constructing the NFA.	*1*	*3*	**8**
			OR			
	4	a)	Explain closure property – complementation with an example.	*1*	*1*	**6**
		b)	Write the regular expressions for the following. i. L={w : n_a(w)mod 3 =0 where w=(a,b)*} ii. L={$a^n b^m$ | m ≥ 1, n ≥ 1, nm ≥ 3}	*1*	*1*	**6**
		c)	Obtain the distinguishable table for the automaton and then minimize the states of the following DFA. → **A** B F **B** G C ***C** A C **D** C G **E** H F **F** C G **G** G E **H** G C	*1*	*3*	**8**
			UNIT - III			
	5	a)	Show that the below grammar is ambiguous. S → iCtS | iCtSeS | a , C → b	*1*	*1*	**4**
		b)	Consider the following context-free grammars. G1: S-> aS | B, B-> b | bB	*1*	*2*	**8**

			G2: S->aA | bB, A-> aA | B | ε , B-> bB | ε Write the Context free language generated by G1 and G2			
		c)	Analyze the given language and obtain a grammar to generate the following languages: i. $L=\{a^{n+2} b^m \mid n\geq 0 \text{ and } m>n\}$ ii. $L=\{a^n b^m c^k \mid n\geq 0 \text{ and } m>n\}$	*2*	*2*	**8**
			OR			
	6	a)	Eliminate useless symbols in the grammar given below: {S →aA | bB , A → aA | a , B →bB , D →ab | Ea , E →aC | d}	*3*	*1*	**10**
		c)	Consider the grammar. S -> 0A | 1B A -> 0AA | 1S | 1 B -> 1BB | 0S | 0 Obtain the grammar in Chomsky Normal Form (CNF).	*1*	*3*	**10**
			UNIT - IV			
	7	a)	State the pumping lemma for Context Free languages. Explain with an example.	*2*	*2*	**5**
		b)	Check if the Push Down Automata (PDA) to accept the language $L(M)=\{w \mid w \text{ (a+b)* and } n_a(w) = n_b(w)$ is deterministic or non-deterministic?	*3*	*3*	**5**
		c)	For the given grammar, obtain the corresponding PDA. S -> aABB | aAA A -> aBB | a B -> bBB | A C -> a	*1*	*1*	**10**
			OR			
	8	a)	Design PDA for accepting $a^n b^{2n}$ such that n>=1.	*3*	*3*	**10**
		b)	Design PDA to accept $a^n b^n$. Also check whether the PDA is DPDA or NPDA.	*3*	*3*	**10**
			UNIT - V			
	9	a)	Discuss about the various components of Turing machine model.	*3*	*3*	**5**
		b)	Find whether the lists given here have a Post Correspondence Solution. M = (abb, aa, aaa) and N = (bba, aaa, aa)	*3*	*3*	**5**
		c)	Design a Turing machine to accept the language $L(M)=\{0^n 1^n 2^n \mid n \geq 1\}$	*3*	*3*	**10**
			OR			

	10	a)	Design TM that adds two numbers. Assume numbers are stored on tape as sequence of 1's and separated by a 0.	*3*	*3*	**10**
		b)	Design TM that accepts palindrome strings of a and b.	*3*	*3*	**10**

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