U.S.N.										

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

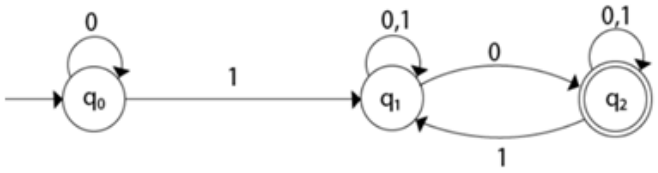
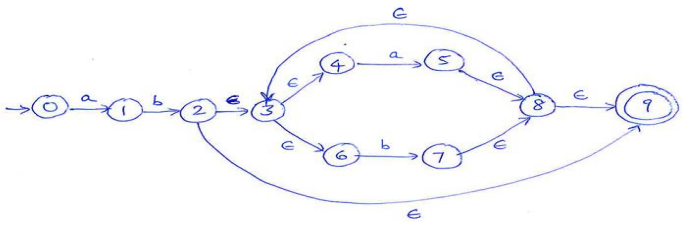
Autonomous Institute Affiliated to VTU

February 2025 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: Information Science and Engineering **Duration: 3 hrs.**
Course Code: 23IS4ESTFC / 22IS4PCTFC **Max Marks: 100**
Course: Theoretical Foundation 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.

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 DFA and NFA.	CO1	PO1	4
	b)	Construct a DFA to accept a string of 0's, 1's & 2's beginning with a 0 followed by odd number of 1's and ending with a 2. Show acceptance and rejection with an example	CO1	PO1	8
	c)	Convert the following NFA to DFA. 	CO1	PO1	8
		OR			
2	a)	Convert the following ε-NFA to equivalent DFA. 	CO1	PO1	10
	b)	Write the complete procedure to minimize the given DFA and also minimize the following DFA:	CO1	PO1	10

δ	a	b
→A	B	F
B	G	C
*C	A	C
D	C	G
E	H	F
F	C	G
G	G	E
H	G	C

			UNIT-II			
	3	a)	Obtain the Regular expression for the following (i) L= {w: |w| mod 3 =0 where w is (a, b)*} (ii) L={$a^n b^m$ | m+n is even}	*CO1*	*PO1*	**6**
		b)	State and prove pumping lemma theorem for regular language.	*CO1*	*PO2*	**6**
		c)	Obtain ε-NFA for the regular expression (a+b)* aba (a+b)*	*CO2*	*PO2*	**8**
			OR			
	4	a)	Compose regular expressions for the following languages: i. Set of all strings of a's and b's that do not end with ab ii. Set of all strings with two or more letters but beginning and ending with different letter, ∑ ={p,q} iii. Set of all strings consisting of 0's and 1's with at most one pair of consecutive ones.	*CO1*	*PO1*	**6**
		b)	Obtain ε-NFA for the regular expression (01+1)*0.	*CO2*	*PO2*	**5**
		c)	State and prove the pumping lemma theorem for regular languages. Also, prove that the language L = {0^n1^n | n >=1}	*CO2*	*PO2*	**9**
			UNIT - III			
	5	a)	Define ambiguous grammar. Show that the grammar shown below is ambiguous. S-->iCtS |iCtSeS| a C--> b	*CO3*	*PO1*	**7**
		b)	Give the formal definition of CFG. Construct a CFG for the following languages i) L={w|$n_a(w)=n_b(w)+1$} ii) L={w|w ∈ {0,1}* with at least one occurrence of '000'}	*CO2*	*PO1*	**7**
		c)	Explain Rightmost Derivation, Leftmost derivation and Parse tree with an example.	*CO2*	*PO1*	**6**
			OR			
	6	a)	Eliminate unit productions from the grammar S -> A0 | B A -> A | 11 B -> 0 | 12 | B	*CO2*	*PO2*	**6**
		b)	Eliminate useless symbols in the following grammar: S -> Aa | bB A -> aA | a B -> bB D -> ab | Ea E -> aC | d	*CO2*	*PO2*	**6**
		c)	Convert the following CFG into CNF : S → 0A| 1B A →0AA| 1S|1 B → 1BB| 0S| 0	*CO3*	*PO2*	**8**
			UNIT - IV			
	7	a)	Obtain PDA to accept a string of balanced parenthesis by final state. The input symbols are : [, (,),].	*CO2*	*PO2*	**10**

		b)	Design a Push Down Automata (PDA) for the following grammar: S -> aA A -> aABC | bB | a B -> b C -> c	*CO2*	*PO3*	**10**
			OR			
	8	a)	Design a PDA to accept WCW^R where w is any binary string and W^R is reverse of that string and C is a special symbol.	*CO2*	*PO2*	**12**
		b)	Give procedure for PDA to CFG conversion.	*CO2*	*PO3*	**08**
			UNIT - V			
	9	a)	Obtain the Turing machine to accept the language: $L=\{0^n1^n \mid n>=1\}$. Write instantaneous description for 00001111.	*CO2*	*PO2*	**12**
		b)	Obtain Turing Machine to perform x+y for unary positive integers over $\{1\}^+$.	*CO3*	*PO2*	**8**
			OR			
	10	a)	Obtain a turing machine to accept the language: $L = \{a^nb^nc^n \mid n>=1\}$. Write Instantaneous description for aabbcc.	*CO2*	*PO2*	**12**
		b)	Design a turing machine that contains string 101.	*CO3*	*PO2*	**08**

****