Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–VI (NEW) EXAMINATION – WINTER 2024

Subject Code:3160704 Date:20-11-2024

Subject Name:Theory of Computation

Time:02:30 PM TO 05:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Define Finite Automata (FA) with an example.	**3**
	(b)	Write regular expressions for the following. (i) Binary numbers that are multiple of 2. (ii) Strings of a's and b's with no consecutive a's . (iii) Strings of a's and b's containing consecutive a's.	**4**
	(c)	Construct a DFA for the language over {0, 1}* such that it contains “000” as a substring.	**7**
Q.2	**(a)**	Define ε-closure(q) with an example.	**3**
	(b)	State the difference between NFA and DFA.	**4**
	(c)	Prove by pumping lemma, that the language 0^n1^n is not regular.	**7**
		OR	
	(c)	What is ambiguous grammar? Is the following grammar ambiguous? 1. E→ E+E |E*E | id 2. E→ E+E|E*E|(E)|a Justify your answer.	**7**
Q.3	**(a)**	State the definition of Pushdown automata.	**3**
	(b)	Is NPDA (Nondeterministic PDA) and DPDA (Deterministic PDA) equivalent? Illustrate with an example.	**4**
	(c)	Construct PDA for the language $L=\{ww^R \mid w\in(a+b)^*\}$	**7**
		OR	
Q.3	**(a)**	State and prove the pumping lemma for CFL. What is its main application? Give an example.	**3**
	(b)	Compare Deterministic PDA and Non deterministic PDA.	**4**
	(c)	Is it true that non deterministic PDA is more powerful than that of deterministic PDA? Justify your answer.	**7**
Q.4	**(a)**	Construct a CFG for set of strings that contain equal number of a’s and b’s over $\sum = \{a,b\}$.	**3**
	(b)	What is chomsky normal form? Explain with an example	**4**
	(c)	Convert the following grammar G in greibach normal form.	**7**

S→ABb|a
A→aaA|B
B→bAb

OR

Q.4	**(a)**	What is a Turing machine?	**3**
	(b)	Design a Turing machine with no more than three states that accepts the language a(a+b)*. Assume $\sum$ = {a,b}	**4**
	(c)	Convert the following grammar into CNF S→cBA, S→A, A→cB, A→AbbS, B→aaa	**7**

Q.5	**(a)**	When we say a problem is decidable? Give an example of an undecidable problem.	**3**
	(b)	Mention the difference between P and NP problems.	**4**
	(c)	Prove that for two recursive languages L1 and L2 their union and intersection is recursive.	**7**

OR

Q.5	**(a)**	What is a recursively enumerable language?	**3**
	(b)	Mention the difference between decidable and undecidable problems.	**4**
	(c)	Explain NP-complete problems with an example	**7**

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