Enrolment No._____

NATIONAL FORENSIC SCIENCES UNIVERSITY, DELHI CAMPUS
B. Tech – M. Tech Computer Science & Engineering (Cyber Security) - Semester V
September 2023, Term Assessment-1

Subject Code: CTBTCSE SV P4
Subject Name: Theory of Computation

Date: 19/09/2023 (Afternoon)
Time: 11:30 am – 12:15 pm
Total Marks: 25

Instructions: All the questions are compulsory

Section A (5 * 2 Mark)

1. Define a DFA.
2. The number of states required to accept the language L= {w: |w| mod 3 = 0}; where Σ = {a, b} is ____.
3. ___number of states required to design the DFA for Question number 2 in Section B.
4. The number of states required in the minimal dfa L = {w|w ∈ {0, 1}*, the number of 0's is divisible by 2 and number of 1's is divisible by 5, respectively is ____.
5. The number of possible substring of length 5 over Σ = {a, b, 0, 1, 2} is____.

Section B (3 * 5 Mark)

1. Construct a NFA that recognizes the set of all strings on Σ = {a, b} starting with the prefix ab. Also, give its state transition table.
2. Design a dfa for the languages L= {ba^n: n ≥ 1, n ≠ 5}.
3. Construct a minimal that accepts the language L, represented by the Σ*0011Σ*, where Σ = {a, b}.

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Enrolment No._____

NATIONAL FORENSIC SCIENCES UNIVERSITY, DELHI CAMPUS
B. Tech - M. Tech CSE (CS) – Semester V, October-November 2023
Mid Semester Examination

Subject Code: CTBTCSE SV P4
Subject Name: Theory of Computation

Date: 02/11/2023
Time: 1 Hr 30 Min
Total Marks: 50

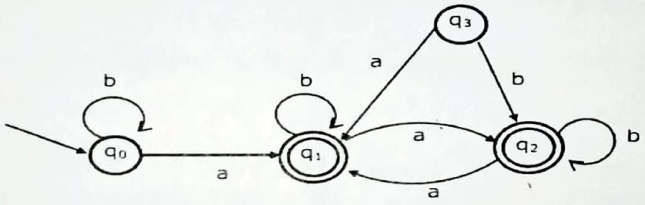
All the questions are compulsory.

Section A (5* 3 Mark)

1. Let N be an NFA with n states & let k be the number of states of a minimal DFA which is equivalent to N. The relations between n & k is____.
2. Give an example finite set and infinite set-in set builder form.
3. Consider the regular expression (0+1) (0+1)…N times. The minimum state finite automaton that recognizes the language represented by this regular expression contains _____ states.
4. Check whether L = $\{a^n b^l \mid n \leq l\}$ is regular or not.
5. The number of reflexive relations on an n-element set is_____.

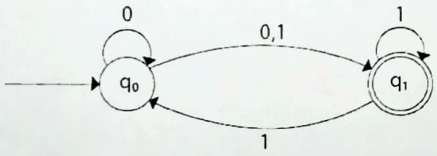
Section B

1. Consider the following Finite State Automaton:

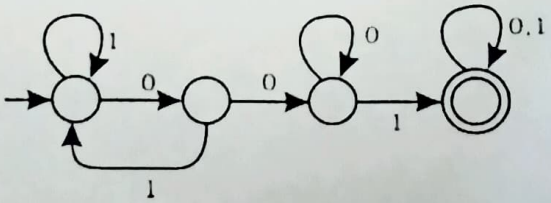


Derive the regular expression using Arden's Theorem. **(5 Mark)**

2. Convert the given NFA to DFA. **(5 Mark)**



3. State Pumping Lemma theorem with example. **(5 Mark)**
4. Consider the following deterministic finite state automaton M.



Let S denote the set of seven bit binary strings in which the first, the fourth, and the last bits are 1. The number of strings in S that are accepted by M is____. **(5 Mark)**

5. The minimum possible number of states of a deterministic finite automaton that accepts the regular language L = $\{w_1 a w_2 \mid w_1, w_2 \in \{a, b\}^*, |w_1| = 2, |w_2| \geq 3$. **(5 Mark)**
6. Discuss with example Moore & Mealy machine. **(10 Mark)**

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Seat No.: _____ Enrolment No._____

NATIONAL FORENSIC SCIENCES UNIVERSITY

B. Tech. - M. Tech. CSE (CS) - Semester – V - Jan-2024

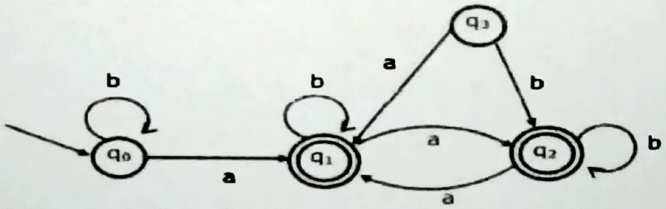
Subject Code: CTBTCSE SV P4 **Date: 04/01/2024**

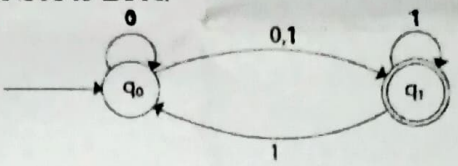
Subject Name: Theory of Computation

Time: 11:00 AM to 2:00 PM **Total Marks: 100**

Instructions:

1. **Write down each question on a separate page.**
2. **Attempt all questions.**
3. **Make suitable assumptions wherever necessary.**
4. **Figures to the right indicate full marks.**

Q.1 (A)	Find the number of transitive relations for a set of n-element.	**04**
	Attempt Any two	
Q.1 (B)	**I.** Construct the truth table for the following statements. **(i)** $\neg p \wedge \neg q$ **(ii)** $(\neg p \rightarrow r) \wedge (p \leftrightarrow q)$ **II.** Prove that the sum of cubes of n natural numbers is equal to $([n(n+1)]/2)^2$ for all n natural numbers. (Hint: use mathematical induction) III. Define the term alphabet, string, and language. Also, give their relationship.	**16**
Q.2 (A)	Construct a minimal DFA that accepts a language L over input alphabets $\sum$ = {a, b} such that L is the set of all strings starting with **'aa' or 'bb'**.	**04**
	Attempt Any two	
Q.2 (B)	I. Derive the regular expression for the DFA given below:  II. State with example Pumping Lemma for regular language. III. Construct a minimal DFA that accepts the language L over the alphabet $\sum = \{0, 1\}$. $L = \{w \in \{0,1\}^* \mid w$ **does not contain three or more consecutive 1 's** $\}$	**16**
Q.3 (A)	Check the grammar is ambiguous or not. (Hint: use the string "abbaba" $G = \{S \rightarrow SS, S \rightarrow ab, S \rightarrow ba, S \rightarrow \epsilon\}$	**04**
	Attempt Any two	
Q.3 (B)	I. Convert the Given context free grammar into its equivalent CNF. S → ASB A → aAS|a|ε B → SbS|A|bb II. Construct a PDA for language L = $\{0^n1^m2^m3^n \mid n>=1, m>=1\}$	**16**

	III. Distinguish between DPDA and NPDA with example.	
Q.4 (A)	Define Turing machine with a suitable example.	**04**
	Attempt Any two	
Q.4 (B)	I. Design a Turing machine for the language $a^n b^n c^n \mid n \geq 1$ II. Discuss with example the ambiguity property in CFG. III. Design a Turing machine to find 1's complement of a binary number.	**16**
Q.5 (A)	Check whether $L = \{a^n b^m \mid n = m\}$ is CFL or not using Pumping lemma.	**04**
	Attempt Any two	
Q.5 (B)	I. Differentiate with example deterministic and non-deterministic Turing machine with example. II. Convert the given NFA to DFA.  III. Discuss with example Moore & Mealy machine.	**16**

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