Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– VI EXAMINATION – SUMMER 2020

Subject Code: 2160704 Date:28/10/2020

Subject Name: THEORY OF COMPUTATION

Time: 10:30 AM TO 01:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** What is a proposition? Which logical connectives do we use to generate compound proposition? **03**

(b) Out of these two statements which one is true and which is false. Justify your answer. **04**

1. $\forall x\big(\exists y((x-y)^2 < 4)\big)$
2. $\exists y\big(\forall x((x-y)^2 < 4)\big)$

(c) Develop an FA corresponding to following regular expression **07**

$$r = (11 + 110)^* 0$$

Explain the properties of Distinguishability of Strings and Equivalence classes, show minimum numbers of states necessary for this FA.

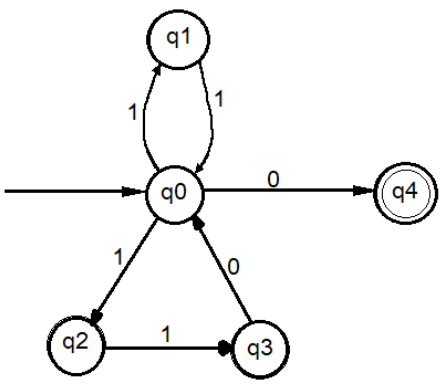
Q.2 **(a)** Write the strong principle of mathematical induction and show that $P(n)$ is true for every$n \geq 2$, where $P(n)$ is the statement: n is either a prime or a product of two or more primes. **03**

(b) Define a CFG for language having strings with equal number of 0's and 1's. **04**
$L = \{ x \in \{0,1\}^* \mid n_0(x) = n_1(x)\}$

(c) L_1 is a language over {0, 1}* that accepts strings ending in 11. L_2 is a language over {0, 1}* that accepts strings containing 101 as sub-string. Write the regular expressions, draw FA for L_1 and L_2 and derive FA for L_1 U L_2. **07**

OR

(c) Apply the subset construction technique to convert the given NFA to FA. **07**



Q.3	**(a)**	What is an Ambiguous CFG? Explain with reference to dangling else problem.	**03**
	(b)	Explain Moore machine and Mealy machine. Give example of two equivalent machines of each type performing similar function.	**04**
	(c)	Derive a CFG equivalent to following regular expression $(011 + 1)^*(01)^*$	**07**
		OR	
Q.3	**(a)**	What are Nullable variable in a CFG? How can we remove them from a production?	**03**
	(b)	Draw NFA-Λ for ((0+1)*10 + (00)*(11)*)*	**04**
	(c)	What are the steps to convert a CFG to Chomsky Normal Form?	**07**
Q.4	**(a)**	Define a Turing Machine.	**03**
	(b)	What language will be generated by this CFG: $S \rightarrow aT \mid bT \mid \Lambda$ $T \rightarrow aS \mid bS$	**04**
	(c)	Develop a DPDA that accepts following language: $L = \{x \in \{a, b\}^* \mid n_a(x) > n_b(x)\}$	**07**
		OR	
Q.4	**(a)**	What is the difference between accepting a Language and Recognizing a Language?	**03**
	(b)	Give transition tables for PDA recognizing the language of all non-palindromes over {a,b}*	**04**
	(c)	Write the pumping lemma for Context-Free Languages and prove that $L = \{ a^i b^i c^i \mid i \geq 1\}$ is not a CFL.	**07**
Q.5	**(a)**	Define Primitive Recursive Functions.	**03**
	(b)	Draw a Turing Machine to accept a regular language {a, b}*{aba}	**04**
	(c)	Develop a Turing Machine to accept even length palindromes over {a,b}*	**07**
		OR	
Q.5	**(a)**	Define Bounded Minimalization of a predicate P.	**03**
	(b)	What important points do we derive from Church-Turing thesis?	**04**
	(c)	Develop a Turing Machine that creates a copy of its input string to the right of the input but with a blank space separating the copy from the original.	**07**

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