

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER- VI EXAMINATION – SUMMER 2020

Subject Code: 2160704

Date: 28/10/2020

Subject Name: THEORY OF COMPUTATION

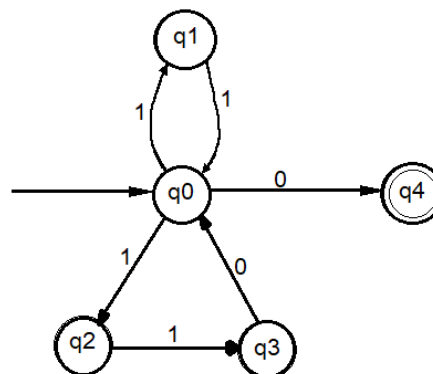
Time: 10:30 AM TO 01:00 PM

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. $\forall x(\exists y((x - y)^2 < 4))$
 2. $\exists y(\forall x((x - y)^2 < 4))$
- (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 $L_1 \cup L_2$. **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 **07**
 $(011 + 1)^*(01)^*$
- 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: **04**
 $S \rightarrow aT \mid bT \mid \Lambda$
 $T \rightarrow aS \mid bS$
- (c) Develop a DPDA that accepts following language: **07**
 $L = \{x \in \{a, b\}^* \mid n_a(x) > n_b(x)\}$
- 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**
