

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-VI OLD) - EXAMINATION – WINTER 2017

Subject Code: 160704

Date: 16-11-2017

Subject Name: Theory Of Computation

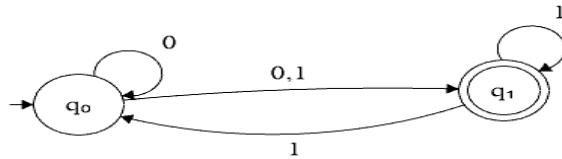
Time: 02:30 pm to 05:00 pm

Total Marks: 70

Instructions:

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

- Q.1** (a) Define relation. Define reflexive and transitive relation. A relation R is given as $R = \{(0,0), (1,1), (2,2), (3,3), (3,1), (1,0), (0,1), (1,3)\}$. Prove that R is reflexive, symmetric but Not transitive. **07**
- (b) Define language. **07**
Draw Deterministic Finite Automata for the following languages
- i) $L_1 = \{x \in (0,1)^* \mid x \text{ contains } 101\}$
 - ii) $L_2 = \{x \in (0,1)^* \mid x \text{ contains odd number of zero and ends with } 00\}$
 - iii) $L_3 = \{x \in (0,1)^* \mid x \text{ ends with } 11\}$
- Q.2** (a) State proof by contradiction. **02**
Prove that $\sqrt{2}$ is an irrational number. **05**
- (b) Define NFA and NFA- Λ . Convert the following NFA to DFA **07**

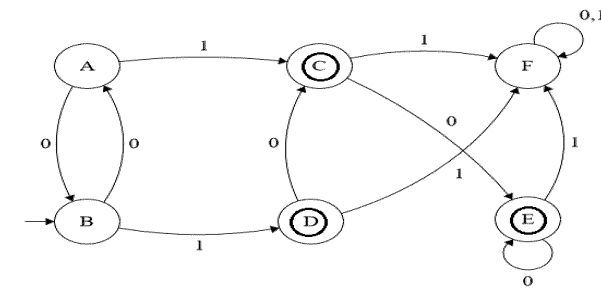


OR

- (b) Define weak principle of mathematical induction. Using Mathematical induction prove that $1+2+3+\dots+n = n*(n+1)/2$ **07**
- Q.3** (a) Define Context Free Grammar. Design a CFG for the following language **07**
 $L = \{a^n b^n \mid n > 0\}$.
- (b) Prove that the following language is ambiguous and convert into unambiguous **07**
 $E \rightarrow E + E \mid E * E \mid id$

OR

- Q.3** (a) Minimize the following FA. **07**



- (b) State pumping lemma for FA. Prove that

07

$L = \{ 0^n1^n \}$ is not regular

- Q.4 (a)** Define PDA. Draw a PDA for the following language **07**
 $L = \{ 0^n1^n \mid w \in (0,1)^* \text{ and } n \geq 0 \}$
- (b)** Write regular expression for the following languages **07**
i) $L_1 = \{ x \in (0,1)^* \mid x \text{ ends with } 11 \}$
ii) $L_2 = \{ x \in (0,1)^* \mid x \text{ contains both } 101 \text{ and } 110 \}$
- OR**
- Q.4 (a)** Prove that any Regular Language can be accepted by FA. **07**
- (b)** Draw the PDA for the following language **07**
 $L = \{ a^i b^j c^k \mid i = j + k \}$
- Q.5 (a)** Convert the following language in Chomsky normal form. **07**
 $S \rightarrow ASB \mid SAB \quad A \rightarrow BC \quad B \rightarrow bB \mid c \quad C \rightarrow e$
- (b)** Write Short note on Universal Turing Machine. **07**
- OR**
- Q.5 (a)** Define a Turing Machine. Design a Turing machine for deleting n th symbol from a string w from the alphabet $\Sigma = \{0,1\}$. **07**
- (b)** Prove that following $\text{add}(x,y) = x+y$ is primitive recursive function. **07**
