

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VI- EXAMINATION – SUMMER 2016

Subject Code:160704

Date:17/05/2016

Subject Name:Theory Of Computation

Time: 10:30 AM to 01:00 PM

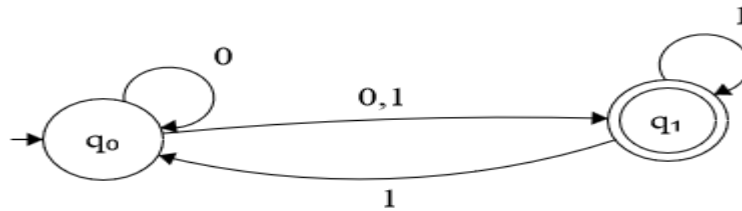
Total Marks: 70

Instructions:

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

- Q.1** (a) Define relation. Define reflexive and transitive relation. A binary relation R on $N \times N$ is defined as $(a,b)R(c,d)$ if $a \leq c$ or $b \leq d$. Prove that R is reflexive but not transitive. **07**
- (b) Define language. **07**
 Draw Deterministic Finite Automata for the following languages
 i) $L_1 = \{ x \in (0,1)^* \mid x \text{ contains } 110111 \}$
 ii) $L_2 = \{ x \in (0,1)^* \mid x \text{ contains odd number of zero and even number of } 1 \}$
 iii) $L_3 = \{ x \in (0,1)^* \mid x \text{ do not contains } 110 \}$

- Q.2** (a) Define mathematical induction. **02**
 Prove that if $0 < a < 1$ then $(1-a)^n \geq 1 - na$. **05**
- (b) Define NFA and NFA- Λ . Convert the following NFA to DFA **07**

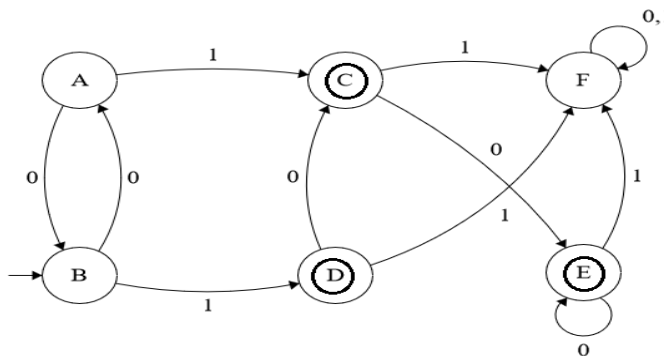


OR

- (b) Using proof by contradiction, prove $\sqrt{3}$ is Not a rational number. **07**
- Q.3** (a) Define Context Sensitive Grammar. Design a CSG for the following language $L = \{ a^n b^n c^n \mid n > 0 \}$. **07**
- (b) Prove that the following language is ambiguous and convert into unambiguous $S \rightarrow S + S \mid S * S \mid a$ **07**

OR

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



- (b) Define Context Free Grammar. Design a CFG for the following language. 07
 $L = \{ x \in (0,1)^* \mid n_0(x) = n_1(x) \}$
- Q.4** (a) Define PDA. Draw a PDA for the complement of the following language 07
 $L = \{ ww^R \mid w \in (0,1)^* \}$
- (b) Write regular expression for the following languages 07
- i) $L_1 = \{ x \in (0,1)^* \mid x \text{ do not ends with } 11 \}$
- 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) Define pumping lemma for regular language. Prove that the language 07
 $L = \{ a^i \mid i \text{ is NOT prime} \}$ is irregular.
- (b) Write Short note on Universal Turing Machine. 07
- OR**
- Q.5** (a) Define a Turing Machine. Design a Turing machine for deleting nth symbol 07
from a string w from the alphabet $\Sigma = \{0,1\}$.
- (b) Prove that following $\text{add}(x,y) = x+y$ is primitive recursive function. 07
