

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-VI • EXAMINATION – SUMMER • 2014

Subject Code: 160704

Date: 28-05-2014

Subject Name: Theory of Computation

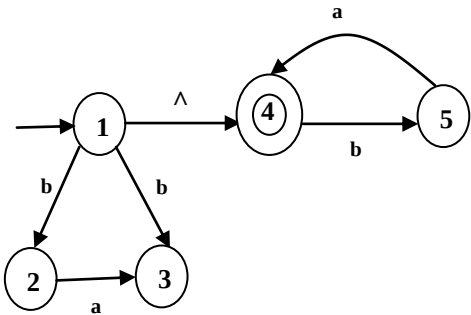
Time: 10:30 am - 01:00 pm

Total Marks: 70

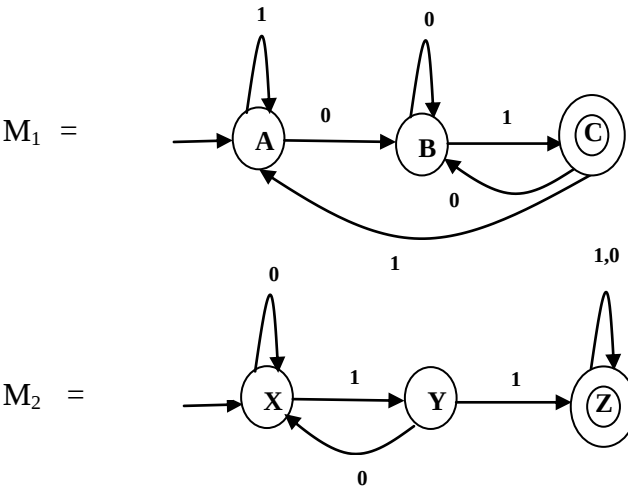
Instructions:

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

- Q.1 (a)** Define One-to-one and Onto Functions. Also explain Compositions and Inverse of functions. **07**
- (b)** Convert the following NFA- Λ into FA. **07**



- Q.2 (a)** Let M_1 and M_2 be the FAs pictured below, recognizing languages L_1 and L_2 respectively. **07**



Draw the FAs recognizing the following languages.

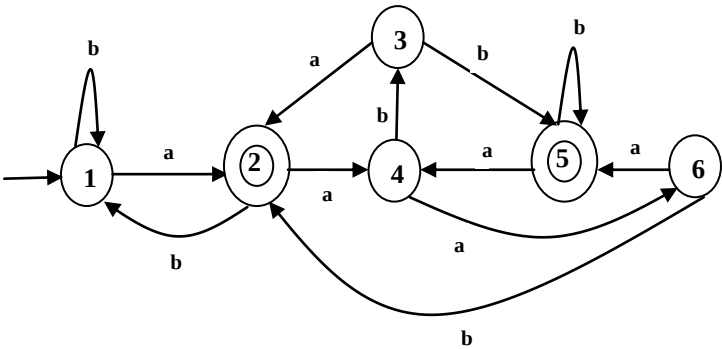
- $L_1 \cap L_2$
 - $L_2 - L_1$
- (b)** Define the Strong Principle of Mathematical Induction. Prove the following using mathematical Induction. **07**

$$7 + 13 + 19 + \dots + (6n+1) = n(3n+4)$$

OR

- (b)** Prove : The language accepted by any finite automaton is regular. **07**

Q.3 (a) Minimize the following DFA (If Possible). **07**



(b) Let L be the language corresponding to the regular expression $(011+1)^*(01)^*$. Find the CFG generating L. **07**

OR

Q.3 (a) Given the CFG G, find a CFG G' in Chomsky Normal form generating $L(G) - \{ \Lambda \}$ **07**

$S \rightarrow A \mid B \mid C$
 $A \rightarrow aAa \mid B$
 $B \rightarrow bB \mid bb$
 $C \rightarrow aCaa \mid D$
 $D \rightarrow baD \mid abD \mid aa$

(b) Prove: The language $pal = \{ x \in \{a, b\}^* \mid x = x^r \}$ cannot be accepted by any deterministic pushdown automaton. **07**

Q.4 (a) What is Pumping Lemma and Equivalence Relation ? **07**

(b) Design and draw a deterministic PDA accepting strings with more a's than b's. Trace it for the string "abbabaa". **07**

OR

Q.4 (a) Define CFG and Design a CFG for the following language. **07**

$L = \{ x \in \{0,1\}^* \mid n_0(x) \neq n_1(x) \}$

Q.4 (b) Attempt the following : **07**

- Draw FA for $(a + b)^* baaa$.
- Write a Regular Expression for the String of 0's and 1's in which number of 0's and 1's are even.

Q.5 (a) Draw the TM to copy string and delete a symbol. **07**

(b) Differentiate Regular Grammars and Context Sensitive Grammars. **07**

OR

Q.5 (a) Define: **07**

- [1] Basic complexity Classes
- [2] Primitive Recursive Functions
- [3] The Time and Space Complexity of a Turing Machine

(b) Explain Polynomial Time Reductions and NP- Completeness. **07**
