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

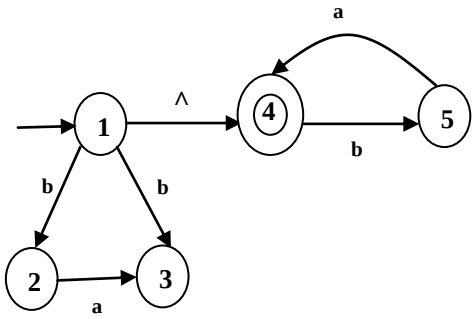
Time: 10:30 am - 01:00 pm Total Marks: 70

Instructions:

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

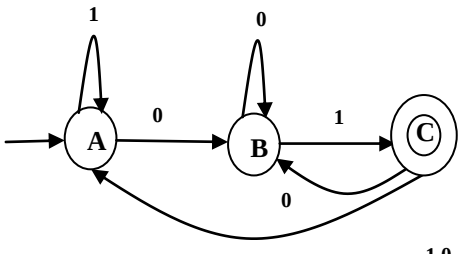
Q.1 **(a)** Define One-to-one and Onto Functions. Also explain Compositions and Inverse of functions. **07**

(b) Convert the following NFA- Λ into FA. **07**

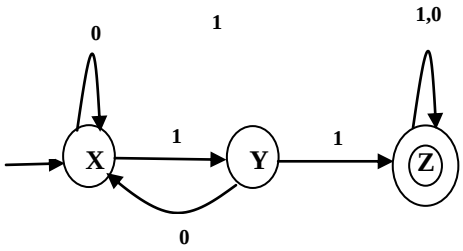


Q.2 **(a)** Let M_1 and M_2 be the FAs pictured below, recognizing languages L_1 and L_2 respectively. **07**

M_1 =



M_2 =



Draw the FAs recognizing the following languages.

- $L_1 \cap L_2$
- $L_2 - L_1$

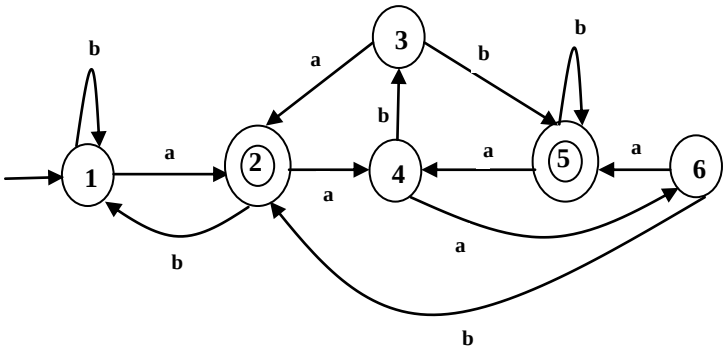
(b) Define the Strong Principle of Mathematical Induction. Prove the following using mathematical Induction. **07**

7+ 13 + 19 + ……+ (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) – { Λ} **07**

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

(b) Prove: The language *pal*= { x ∈ {a, b}* | 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 ∈ {0,1}* | $n_0(x) \neq n_1(x)$ }

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**

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