VIT UNIVERSITY
(Estd. u/s 3 of UGC Act 1956)

Term End Examination - May 2013

Course : ITE203 - Theory of Computation **Slot: D1+TD1**

Class NBR : 2911/2913

Time : Three Hours **Max.Marks:100**

PART – A (8 X 5 = 40 Marks)
Answer ALL Questions

1. Define the transition function for the following machines
   a) DFA **[2]**
   b) Turing Machine **[2]**
   c) Moore Machine **[1]**
2. Define the following
   a) Greibach Normal form (GNF) **[2]**
   b) Recursive Enumerable Language **[2]**
   c) Left Linear Grammar **[1]**
3. Design a Turing machine to compute the following function **[5]**

   $f(x) = 2x + 3$

   Where *x* is the positive integer represented in unary.
4. Explain the basic model of Linear Bounded automata. **[5]**
5. Exhibit the relationship between grammars by Chomsky Hierarchy. **[5]**
6. Define the following with example
   a) Decidable and Un-decidable Problem **[2]**
   b) NP Problem **[2]**
   c) NP Complete Problem **[1]**
7. Explain the post's correspondence problem with one example. **[5]**
8. Explain the halting problem of Turing machine. **[5]**

PART – B (6 X 10 = 60 Marks)
Answer any SIX Questions

9. a) Find the DFA for the following languages on ∑ = {0, 1}

   i. {w | w does not contain substring 110} **[3]**

   ii. {w | w has a length at least 3 and third symbol is 0} **[2]**

   b) Construct the finite automata equivalent to the following regular expression. **[5]**

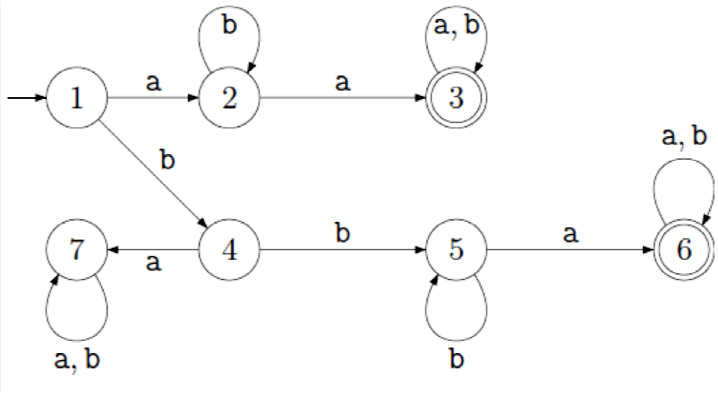
$$(11+0)^* 011$$

10. a) Show that following language is not regular **[5]**

$$L = \{a^n : n \text{ is perfect square}\}$$

   b) Design a Moore machine to determine the residue mod 3 for each binary string treated as a binary string. **[5]**

11. Minimize the following DFA **[10]**



12. a) Find the CFG for the following languages

   i. $L = \{a^n b^m c^k : k = n + m\}$ **[2]**

   ii. $L = \{ab^5 wb^2 : w \in \{a,b\}^*\}$ **[3]**

   b) Prove the following CFG is ambiguous. **[5]**

$$S \rightarrow aS \mid aSaS \mid \in$$

13. Convert the grammar **[10]**

$$S \rightarrow aXbX$$

$$X \rightarrow aY \mid bY \mid \in$$

$$Y \rightarrow X \mid c$$

Into Chomsky normal form.

14. Find an PDA that accepts following language **[10]**

$$L = \{a^n b^{n+m} c^m : n \geq 0, m \geq 1\}$$

15. Design the Turing machine that accept the language **[10]**

$$L = \{ww : w \in \{a,b\}^*\}$$

16. Construct Turing Machine (TM) that computes the following function **[10]**

$$f(w) = w^R \text{ where } w \in \{a,b\}^*$$

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