

**BACHELOR IN COMPUTER  
APPLICATIONS****Term-End Examination****December, 2008****CS-73 : THEORY OF COMPUTER SCIENCE***Time : 3 hours**Maximum Marks : 75*

**Note :** Question number 1 is **compulsory**. Attempt any **three** questions from the rest.

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1. (a) Define the following concepts formally from the discipline of Theory of Computation. 20
- (i) Non-Deterministic Finite Automata
  - (ii) Regular grammar
  - (iii) Context-free language
  - (iv) Deterministic Push Down Automata
  - (v) Non-Deterministic Turing Machine
  - (vi) Regular language over an alphabet set
  - (vii) Primitive recursive function
  - (viii) Undecidable/unsolvable problem
  - (ix) Context-free grammar
  - (x) Gödel number

(b) Define the following problems :

(i) The Halting problem

(ii) Post Correspondence Problem

Further, tell for each, whether it is an undecidable or decidable problem. 10

2. (a) Construct a Deterministic Finite Automata accepting the following language L :

$L = \{w \in \{0, 1\}^* : w \text{ has even number of 1's and even number of 0's}\}$   $7\frac{1}{2}$

(b)  $L = \{w \in \{a, b\}^* : \text{each } b \text{ is preceded by at least one 'a' and followed by at least one 'a'}\}$   $7\frac{1}{2}$

3. Construct a Turing Machine for each of the following functions :

$7\frac{1}{2} + 7\frac{1}{2}$

(i)  $f(m, n) = m + n$

(ii)  $f(m, n) = m \times n$

4. Construct context-free grammar for each of the following languages :

$7\frac{1}{2} + 7\frac{1}{2}$

(i)  $L = \{x \in \{a, b\}^* : \text{number of a's in } x \text{ equals number of b's in } x\}$

(ii)  $L = \{x \in \{a, b\}^* : \text{number of a's in } x \text{ is NOT equal to number of b's}\}$

5. (a) Show that the monus function, defined as follows is primitive recursive :

$$\text{monus}(m, n) = \begin{cases} m - n, & \text{if } m \geq n \\ 0, & \text{otherwise} \end{cases} \quad 7\frac{1}{2}$$

- (b) In context of primitive recursive functions, state the initial functions and the rules of primitive recursion and composition.

7 $\frac{1}{2}$

