No. of Printed Pages : 3

CS–73

BACHELOR IN COMPUTER APPLICATIONS

13550

Term-End Examination

December, 2010

CS–73 : THEORY OF COMPUTER SCIENCE

Time : 3 hours *Maximum Marks : 75*

Note : *Question No. 1 is **compulsory**. Attempt **any three** questions from the rest.*

---

1. (a) What do you understand by the following ? Explain each with an appropriate example. **4x2=8**

(i) Kleene closure.

(ii) Regular language.

(iii) Finite Automation.

(iv) NP Hard problem.

(b) Build a Finite Automata that accepts only those words that do not end with ba, with alphabet $\Sigma = \{a, b\}$. **5**

(c) Give a regular expression that has all strings that do not end in a double letter. ($\Sigma = \{a, b\}$). **3**

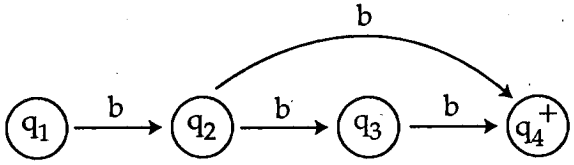
(d) Find a Grammar for the language of even palindromes over {a, b}. **3**

(e) Design a TM that accepts the language of all strings over {a, b} which contain aba as a substring. 5

(f) Show that $n ! = O(n^n)$. 4

(g) What do you mean by time complexity and space complexity of problem ? 2

2. (a) Derive a finite Automata from NFA given as follows : 5



(b) Convert the following regular expression into a finite Automata given as follows : 5

$(0 + 1)^* (00 + 11) (0 + 1)^*$

(c) Design a TM which transforms a string #w# to #w#w#. 5

3. (a) Show that the following language is not regular 6

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

(b) Write a short note on 'Post correspondance problem'. Describe its significance/utility in brief. 5

(c) What are the applications of regular expressions ? Illustrate with an appropriate example. 4

4. (a) Design the PDA which accepts is the language described as follows : 5

$L = \{ wcw^T / w\Sigma \{a,b\}^* \}$

(b) Show that the language given below, is not context free. $\{ a^p ! p \text{ is prime} \}$. 5

(c) Show that the predecessor function described by : 5

pred : $N \rightarrow N$ defined as

$$\text{pred}(n) = \begin{cases} 0 & \text{if } n = 0 \\ n-1 & \text{if } n \geq 1 \end{cases}$$

is primitive recursive.

5. (a) Show that the blank tape halting problem is undecidable. 4

(b) For the function defined by 6

$f(x) = 2x^3 + 3x^2 + 1$ and

$h(x) = 2x^3 - 3x^2 + 2$ show that these may be described by following asymptolic orders respectively.

(i) $f(x) = \Omega(x^3)$

(ii) $h(x) = \Omega(x^2)$

(c) Show that Travelling salesman problem is NP complete. 5
