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CS-73

BACHELOR OF COMPUTER APPLICATIONS (PRE-REVISED)

07004

Term-End Examination

December, 2013

CS-73 : THEORY OF COMPUTER SCIENCE

Time : 3 hours *Maximum Marks : 75*

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

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1. (a) Write regular expression for the languages **4**

(i) The set of strings over alphabet {0, 1} starting with 0.

(ii) The set of strings recognised by $(a + b)^3$ over $\sum = \{a, b\}$

(b) Construct a Deterministic Finite Automata (DFA) for the regular expression $aa^*.bb^*$. **6**

(c) Show that if L_1 and L_2 are context free languages, then L_1L_2 is also context free. **5**

(d) Construct a Push-Down Automata (PDA) accepted by empty stack, for the language $L = \{a^m b^m c^n : m, n \geq 1\}$ **5**

(e) Explain Turing-Machine (TM) with the help of block diagram. **5**

(f) What is halting problem for TM ? Explain with example. **5**

2. (a) Convert the following NFA to a DFA and informally describe the language accepted by DFA. 8

	0	1
→ p	{p, q}	{p}
q	{ r, s}	{t}
r	{p, r}	{t}
s*	ϕ	ϕ
t*	ϕ	ϕ

Note : * on state indicates final state.

(b) Give Context-Free Grammar (CFG) for the following language $L = \{a^m b^n \mid n > m\}$. 3

(c) Test whether the following grammar is ambiguous $S \rightarrow OS1S|1SOS|\in$ 4

3. (a) Find the Chomsky Normal Form (CNF) equivalent to the following CFG. 5

$$\begin{pmatrix} S \rightarrow aAbB \\ A \rightarrow aA \\ B \rightarrow bB \mid b \end{pmatrix}$$

(b) Prove that the language $L = \{a^p : p \text{ is a prime}\}$ is not context free language. 5

(c) Construct a Push-Down-Automata (PDA) for the grammar $\begin{pmatrix} S \rightarrow aB \mid bA \\ A \rightarrow a \mid aS \mid bAA \\ B \rightarrow b \mid bS \mid aBB \end{pmatrix}$ 5

4. (a) Design a TM to compute proper substraction of two unary numbers. The proper substraction function f is defined as follows : 8

$$f(m, n) = \begin{cases} m - n & \text{if } m > n \\ 0 & \text{otherwise} \end{cases}$$

(b) Show that for two recursive languages L_1 and L_2, each of the following is recursive : 7

(i) $L_1 \cup L_2$

(ii) $L_1 \cap L_2$

5. (a) Explain the following with the help of an example each : 6

(i) Partial Function

(ii) Total Function

(iii) Constant Function

(b) Show that the blank-tape halting problem is undecidable. 4

(c) Explain the following : 5

(i) NP-Complete problem

(ii) NP-Hard problem