Total number of printed pages–5

53 (IT-503) THCP

2015

THEORY OF COMPUTATION

Paper : IT 503

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

Answer **any five** questions out of seven.

1. (a) Define the following with example.

    3×2

   (i) Alphabet

   (ii) String

   (iii) Language

   (b) Draw the DFA for the following languages   5+5

   (i) Languages over the alphabet $\sum = \{0, 1\}$ that have the set of all strings that either begins or ends or both with '0'.

Contd.

(ii) Languages over the alphabet $\sum = \{a, b\}$ that have the set of all strings where the second last symbol from the start is '*a*'.

(c) Discuss the properties and limitations of Finite State Machines.   4

2. *(a)* Define in detail Chomsky classification of grammar and also define Chomsky hierarchy.   3+4

   (b) What is pumping lemma ? Using pumping lemma for the language $L = \{a^n b^m \mid n <= m\}$ is not regular.

                                3+5

   (c) When a language is said to be recursive or recursively enumerable ?   5

3. *(a)* Consider the following grammar   9

     $S \to bA \mid aB$

     $A \to bAA \mid aS \mid a$

     $B \to aBB \mid bSb$

     Find left-most derivation and right-most derivation and parse tree for the string '*baaabbabba*'.

(b) Write the CFG for the language

$$L = \left\{ 0^n 1^n \mid n \geq 1 \right\}$$ 6

(c) Construct a DFA for the regular expression $aa^* \mid bb^*$. 5

4. *(a)* Explain the Ambiguity of a grammar. Show that $id + id * id$ can be generated by two distinct left-most derivation in the grammar

$$E \rightarrow E + E \mid E * E \mid (E) \mid id$$ 3+6

(b) Obtain Greiback normal form equivalent to the following context free grammar 8

$$S \rightarrow 0 \mid AA$$
$$A \rightarrow 1 \mid SS$$

(c) Define right-linear and left-linear grammar. 3

5. *(a)* Define Deterministic Pushdown Automata (DPDA). Is it true that DPDA and PDA are equivalent in the sense of language acceptance in concern ? 3+4

(b) Construct PDA for language L.   6

$$L = \left\{ a^n b^{2m} \mid m, n > 1 \right\}$$

(c) Convert the following NFA into DFA, where δ is given as   7

	0	1
p	p, q	p
q	r	r
r	s	—
s	s	s

6. (a) Define context-free grammar (CFG) and write down its differences from context-sensitive grammar (CSG). What are the disadvantages of CFG in compared to CSG ?   2+2+2

(b) Remove ε-transitions from the following grammar.   6

$S \rightarrow aSbS \mid bSaS \mid \varepsilon$

$S \rightarrow AB \mid aaB$

$A \rightarrow a \mid Aa$

$B \rightarrow b$

(c) Let $\sum = \{a, b\}$, give the regular expression
for the following languages :   4+4

(i) $L = \{W \mid |W| <= 4, W \in \Sigma^*\}$

(ii) $L = \{a^{2n}b^{2m+1} \mid n >= 0, m >= 0\}$

7. (a) Define Turing Machine (TM).
Differentiate the deterministic and non-
deterministic Turing Machine.   2+4

(b) Construct a Turing Machine for the
language L 8

$$L = \{WcW^R \mid W \in \{0, 1\}\}$$

(c) Give the regular expression accepted
the following DFA.   6