M.Tech. 1st Semester (Computer Engg.) Examination, December–2017

MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE

Paper–MTCE–603–A

Time allowed : 3 hours] *[Maximum marks : 100*

Note : *Attempt any five questions. All questions carry equal marks.*

1. (a) Construct DFA for the language $L = (a + b)^* aabb$. 10

(b) Let r_1 r_2 and r_3 be three regular expressions. Is the language associated with $(r_1 + r_2) . r_3$ is same as language associated with $r_1 r_3 + r_2 r_3$? Justify your answer ? 10

2. (a) Construct a DFA equivalent to the grammar

$S \rightarrow as \mid bs \mid aA \quad A \rightarrow bB \quad B \rightarrow aC \quad C \rightarrow \in$

(b) Explain Arden's method for the conversion of NFA to DFA with example.

3. (a) Convert the following grammar into Griebach Normal form (GNF) $A \rightarrow aAa \mid bAb \mid a \mid b \mid aa \mid bb$. 10

(b) Determine whether the following grammar is ambiguous or not

$A \rightarrow aAAb \mid bAAa \mid \varepsilon$ for abab. 10

4. (a) Design a TM which can multiply two positive integers. 15

(b) Explain the procedure for conversion of Regular expression into DFA. 5

5. (a) Construct a CFG which accept N(A) where

$A = [\{q_0, q_1\}, \{a, b\}, \{z_0, z\}, \delta, q_0, z_0, \phi]$

$\delta(q_0, b, z_0) = \{(q_0, z z_0)\}$	$\delta(q_0, b, z) = \{q_0, z z)\}$
$\delta(q_0, \wedge, z_0) = \{(q_0, \wedge)\}$	$\delta(q_0, a, z) = \{(q_1, z)\}$
$\delta(q_1, b, z) = \{(q_1, \wedge)\}$	$\delta(q_1, q, z_0) = \{q_0, z_0)\}$

5

(b) Find at least three solutions to PCP defined by dominoes

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111	0	10

15

6. (a) Can you simulate a Turing Machine on a general purpose computer or vice versa ? Explain. 10

(b) State and prove Rice's theorm. 10

7. Explain the following :

(i) Halting problem

(ii) Linear bound Automata

(iii) Solvability and undecidability. 20

8. (a) Prove that $f(x) = x/2$ is a partial recursive function on rN.

(b) Show that following functions are primitive recursing :-

(i) Constant functions a and b. ie $a(x) = a$

$b(x) = b$.

(ii) Identity function

(iii) Head function ie head $(a_1, a_2 \ldots, a_n) = a_1$. 20