Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent institution of MAHE, Manipal)

IV SEMESTER B.TECH. (COMPUTER SCIENCE AND ENGINEERING)

END SEMESTER EXAMINATIONS, APRIL 2018

SUBJECT: FORMAL LANGUAGES AND AUTOMATA THEORY [CSE 2201]

REVISED CREDIT SYSTEM
(17/04/2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. Give a grammar that generates all real constants in **C++**. **3M**

1B. Let ∑ = {a, b}, find a DFA with **3** states for accepting the language L = { w : (n_a(w) + 2n_b(w)) mod 3 < 2} **3M**

1C. Using **mark** and **reduce** procedure, minimize the DFA in **Figure 1C**.

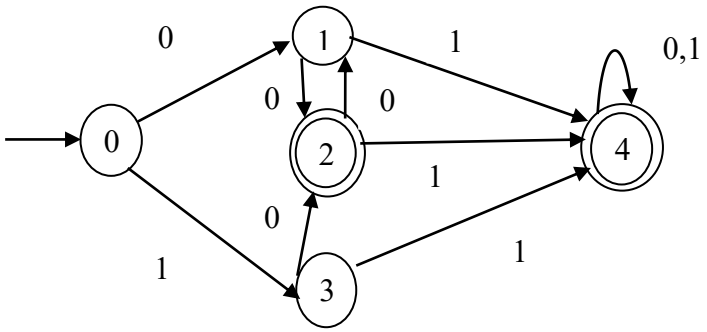

Figure 1C **4M**

2A. Find a regular expression for the language L = {w ε {a, b}*: n_a(w) and n_b(w) are both even} using **nfa-to-rex** procedure. **5M**

2B. Let L_1 = L(0*10*) and L_2 = (10*1). Design a DFA for L_1/L_2 and then find L_1/L_2. **2M**

2C. Prove that L = {w: w = w^R, w ε {0, 1} * } is not regular using Pumping lemma. **3M**

3A. Define ambiguity in context free grammar. Show that the grammar with the following productions: E → E – E, E → 0 | 1 is ambiguous. Construct an equivalent unambiguous grammar. **4M**

3B. Remove all unit-productions, all useless productions and all λ-productions from the grammar:

S →aCbb
B → CD
C → D | a | λ
D → B | b | λ

4M

3C. Define Chomsky normal form and Greibach normal form with an example for each. **2M**

4A. Construct an NPDA with **3** states for L = {w ε {a, b}*: $n_a(w) = n_b(w) + 1$ }. Give instantaneous description (ID) for the string **baaba.** **4M**

4B. Let $L_1 = \{a^n b^n : n \geq 0\}$ and $L_2 = \{a^n b^{2n} : n \geq 0\}$ are deterministic context free languages. Design PDA for $L = L_1 \cup L_2$. Is L deterministic? Justify your answer. **3M**

4C. Show that the following language is context-free.
L = { w ε {a, b}* : $n_a(w) = n_b(w)$, w does not contain the substring **aab** } **3M**

5A. For ∑ = { (,) }, design a Turing machine with **4** states for the language L = {w: w contains balanced parenthesis}. For example (( ))( ) and (( )) are balanced parentheses, but (( ))(and (( ) are not. Give ID for the string (( ))( ). **4M**

5B. Design a linear bounded automata (LBA) with **7** states for the language $L = \{a^n b^n c^n : n \geq 1\}$ **3M**

5C. (a) Define decidable and undecidable problems. Give an example for each.
(b) Define recursive language. Give an example. **3M**

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