No. of Printed Pages : 3 **CS-73**

BACHELOR OF COMPUTER APPLICATIONS (BCA) (Pre-Revised)

Term-End Examination

01470 **June, 2017**

CS-73 : THEORY OF COMPUTER SCIENCE

Time : 3 hours *Maximum Marks : 75*

Note : *Question number 1 is* ***compulsory****. Attempt any* ***three*** *questions from the rest.*

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1. (a) Write down the regular expression for the language

$$L = \{a^{2n} b^{2m+1} \; n \geq 0, m \geq 0\}.$$ *2*

(b) List two main differences between DFA (Deterministic Finite Automata) and NFA (Non-deterministic Finite Automata) *3*

(c) If L is a regular language, then show that the complement of L that is $\bar{L}$ is also regular. *5*

(d) Show that the grammar

$$S \rightarrow a \mid abSA \mid aAb$$

$$A \rightarrow bS \mid aAAb$$

is ambiguous. *5*

(e) Construct a Finite automata for the language $L = \{a^n b^m \mid m, n \geq 1\}$. 5

(f) Define Type-2 grammar. Find the highest type that can be applied to the following productions : 5

(i) $S \rightarrow Aa, \quad A \rightarrow c \mid Ba \quad B \rightarrow abc$

(ii) $S \rightarrow ASb \mid d \quad A \rightarrow aA$

(g) Explain any three uses of regular expressions. 5

2. (a) Design a TM that accepts

$$L = \{0^n 1^n \mid n \geq 1\}.$$ 5

(b) Define O ("Big-O") notation. Show that

$$3x^2 + 2x + 5 = O(x^2).$$ 5

(c) Construct a PDA to accept

$$\mathcal{L} = \{w c w^R \mid w \in (0, 1)^*\}$$

where w^R is the reverse of w. 5

3. (a) Show that

$$\mathcal{L} = \{0^i 1^i \mid i \geq 1\}$$

is not regular. 5

(b) $HALT_{TM} = \{(M, w) \mid$ The Turing machine halts on Input w $\}$ is undecidable. 5

(c) Define pumping lemma for context-free grammar. 5

4. (a) Find out DFA for the machine

$$M = (\{q_0, q_1, q_2\}, \{a, b\}, \delta, q_0, \{q_2\})$$

for the table given below : 5

States \ Σ	a	b
$\rightarrow q_0$	q_0, q_1	q_0
q_1	q_0	q_1
q_2	–	q_0, q_1

(b) Find the regular expression over $\Sigma = \{a, b\}$ that accepts the following sets : 5

(i) All strings over Σ that start and end with different alphabets.

(ii) All strings of a's and b's in which a is divisible by 3.

(c) Write a Regular grammar for the language $(ab \cup aba)^*$. 5

5. (a) Define the following : 5

(i) Application of Finite Automata

(ii) NP-complete problems

(b) Show that $f(x, y) = x^y$ is a primitive recursive function. 5

(c) If L_1 and L_2 are context-free languages, then show that $L_1 \cdot L_2$ is also a context-free language. 5
