International Islamic University Chittagong

Department of Computer Science & Engineering

Program: B.Sc.(Engg.) in CSE

Final Examination, Spring-2019

Course Code: CSE-3609/2425 **Course Title: Theory of Computing**

Time: 2 hour and 30 mins. **Total Marks: 50**

[Answer any *two* questions from **Group-A** and any *three* questions from **Group-B;** Separate answer script must be used for Group-A and Group-B.]

Group-A

1. a) Construct a Deterministic Finite Automata , $\sum = \{a,b\}$ and $L(M) = \{\omega | \omega$ starts and ends with different symbol $\}$. 5

   b) Construct a NFA with state transition table , where second symbol from RHS (right hand side) is 'a' and also convert from NFA to DFA. Assume the input alphabets are a,b. 5

2. a) Define Grammar. 2+3=5
   Suppose, L (G) = $\{a^m b^n \mid m \geq 0$ and $n > 0\}$. We have to find out the grammar **G** which produces **L(G)**.

   b) According to Noam Chomosky, mention the types of Grammar with examples. 5

3. a) Construct push down automaton from the following grammar: 4
   $S \rightarrow aTb \mid b$
   $T \rightarrow Ta \mid \varepsilon$

   b) Using the pumping lemma show that the following languages are not context free: 3+3
   i) $\{ a^n b^n c^n \mid n>=0\}$
   ii) $\{ a^i b^j c^k \mid 0<=i<=j<=k \}$

Group-B

4. a) Describe the ***Church Turing thesis***? 5
   Let $\sum = \{0,1\}$. Draw the state transition diagram for a Turing Machine whose language is $L = \{w \in \sum^* \mid w$ **contains *01* as substring**$\}$

   b) Remove null production from the following grammar: 5
   S---->ABAC , A--→aA|Є , B-→bB|Є , C---→c

5. a) Show that E_{DFA} and EQ_{DFA} are decidable languages. 3+3

   b) Show that the set of rational numbers is countable. 4

6. a) Differentiate among finite state machine , pushdown automata and turing machine. Write down the rules of operation for turing machine. 2+3=5

   b) Define ambiguous grammar. Design a turing machine which recognizes the language, L=01*0 105 P 2+3=5

7. a) Show that every Non-deterministic Turing Machine has an equivalent Deterministic Turing Machine. 5

   b) Prove that the Halting Problem for Turing Machine is undecidable. 5