18-11-16

COMP 5 – 2 (RC)

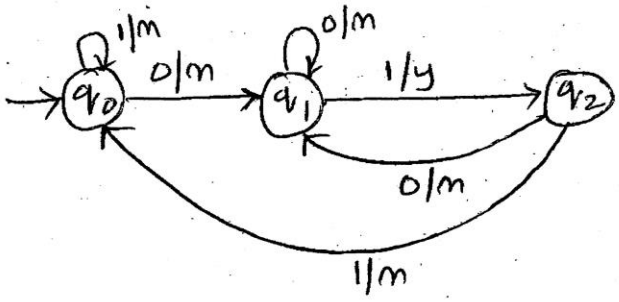
T.E. (Comp.) (Semester – V) (RC) Examination, Nov./Dec. 2016
AUTOMATA LANGUAGES AND COMPUTATION

Duration : 3 Hours | Total Marks : 100

Instructions : *Assume data* ***wherever*** *required. Answer* ***any 5*** *questions with atleast* ***one*** *from* ***each*** *Module.*

MODULE – I

1. a) Convert the following mealy machine to an equivalent Moore machine. **6**



b) State Kleen's Theorem. Prove Part – I of Kleen's Theorem. **6**

c) Determine regular expressions for the following languages.
   i) $L = \{W : |W| \bmod 3 = 0\}$
   ii) $L = \{a^{2n} b^{2m+1} \mid n \geq 0, m \geq 0\}$. **4**

d) State pumping lemma for regular languages. Prove that the language.
   $L = \{0^n | n \text{ is perfect square}\}$ is not regular. **4**

2. a) Construct DFA for the following languages.
   i) $L = \{W : |W| \bmod 5 \neq 0\}$ where $\Sigma = \{a, b\}$.
   ii) $L = \{W (ab + ba) | W \in \{a, b\}^*\}$. **6**

b) Construct mealy machine for binary adder. Convert this mealy machine to an equivalent Moore machine. **8**

c) Construct a DFA to recognize the set of strings over $\Sigma = \{a, b\}^*$ that contain the same number of occurrences of the substring 'ab' as that of substring 'ba'. **6**

P.T.O.

MODULE – II

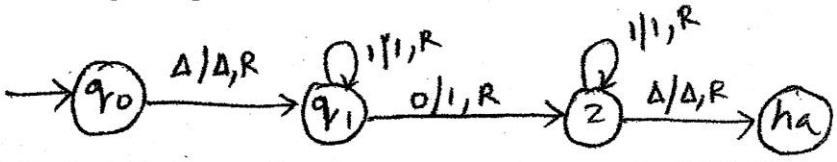
3. a) Construct a top down push down automata for the following context free grammar.
   $S \rightarrow a \mid aS \mid bSS \mid SSb \mid SbS$
   Draw transition table and hence validate the string "abbaa". **8**
   b) Design a context free grammar for the following language.
   $L = \{a^n b^m c^k \mid n + 2m = k \text{ for } n \geq 0, m \geq 0\}$ **6**
   c) State and explain properties of context free languages. **6**

4. a) What is Greibach Normal Form ? Convert the following context free grammar into Greibach Normal Form.
   $Q \rightarrow Aa \mid B$
   $B \rightarrow aa \mid C$
   $C \rightarrow a \mid bd \mid c$
   $A \rightarrow b.$ **8**
   b) Prove that "If L_1 and L_2 are context free languages then $L_1 \cup L_2$, $L_1.L_2$ and L_1^* are also context free languages". **6**
   c) Construct a push down automata for the language $L = \{W \mid n_a(w) > n_b(w)\}$. **6**

MODULE – III

5. a) Write short note on variants on Turing machine. **6**
   b) Design a Turing machine for the language
   $L = \{a^i b^j \mid i > j\}$ over $\Sigma = \{a, b\}$. **6**
   c) Design a Turing machine that recognizes palindrome strings over $\Sigma = \{a, b\}^*$. **8**

6. a) Explain universal Turing machine with all its encoding functions. Encode the following Turing machine 'T'. **10**



   b) Design a Turing machine that accepts the language $L = \{a^n b^n c^n \mid n \geq 1\}$. **8**
   c) State Church-Turing Thesis. **2**

MODULE – IV

7. a) Write short notes on : **12**
   i) Recursively enumerable language
   ii) Linear bounded automata
   iii) Unrestricted grammar
   iv) Context sensitive grammar.

   b) Construct context sensitive grammar for the following language. **8**
   $L = \{a^n b^n a^{2n} \mid n \geq 1\}$

8. a) Write short notes on : **12**
   i) Full trio
   ii) Rice theorem
   iii) Halting problem
   iv) Chomsky hierarchy.

   b) Construct unrestricted grammar for the language **8**
   $L = \{a^i b^i c^i \mid i \geq 1\}$.