29/11/2013 E

COMP 5 – 2 (RC)

T.E. (Computer) (Semester – V) Examination, Nov./Dec. 2013
(Revised Course)
AUTOMATA LANGUAGE AND COMPUTATION

Duration : 3 Hours Total Marks : 100

Instructions : 1) *Answer* ***any five full*** *questions, at least* ***one*** *from each Module.*

2) ***Make*** *suitable assumptions* ***wherever*** *necessary.*

MODULE – I

1. a) Construct the DFA for the following language : 8

   $L(M) = \{w \varepsilon \{a,b\}^* \mid w$ contains baba or doesn't contain ab $\}$.

   b) Construct the regular expression for the given DFA $M = (\{A, B, C\}, \{0, 1\}, \delta, A, \{B, C\}$ where δ is defined as $\{\delta(A, 0) = B, \delta(A, 1) = C, \delta(B, 0) = A, \delta(B, 1) = C, \delta(C, 0) = B, \delta(C, 1) = B\}$. 8

   c) Prove that the language $L(M) = \{0^m1^n \mid m \neq n\}$ is not regular language. 4

2. a) Construct the NFA for the language $L(M) = \{x \varepsilon \{a, b\}^* \mid x$ contains a substring bb or bab$\}$. Draw the computation tree for the string bbab. 4

   b) Construct the ε – NFA which accepts L(r) where $r = (0 + 11)^* (10^* + \varepsilon)$. Convert the constructed ε – NFA to NFA. 3

   c) Minimize the following DFA using table filling method : 6

   $M = (\{A, B, C, D, E, F, G, H\}, \{a, b\}, \delta, A, \{C\})$ where δ is $\delta = \{\delta(A, a) = F, \delta(A, b) = B, \delta(B,a) = C, \delta(B,b) = G, \delta(C, a) = C, \delta(C, b) = A, \delta(D, a) = G, \delta(D, b) = C, \delta(E, a) = F, \delta(E, b) = H, \delta(F, a) = G, \delta(F, b) = C, \delta(G, a) = E, \delta(G, b) = G, \delta(H, a) = C, \delta(H, b) = G\}$.

   d) Construct the Mealy Machine to convert each occurrence of substring 100 by 101. Convert the Mealy Machine to equivalent Moore Machine. 7

P.T.O.

MODULE – II

3. a) Construct the CFG for the language $L(G) = \{0^i1^j2^k \mid k \leq i \text{ or } k \leq j\}$. Convert the constructed CFG to CNF. 8

   b) Prove that the CFL's are not closed under : 4
      i) Intersection
      ii) Complement.

   c) Construct the PDA for the language $L(M) = \{0^n1^m2^{2m} \mid n, m \geq 0\}$. 4

   d) Show that the language $L(M) = \{a^ib^jc^k \mid i = j = k \text{ and } i, j, k \geq 1\}$ is not CFL. 4

4. a) Define Instantaneous Description in a PDA. Construct the bottom-up PDA for the given CFG $G = (\{S, A, B\}, \{a, b\}, \{S \rightarrow AB|\varepsilon, A \rightarrow aaA|\varepsilon, B \rightarrow bB|\varepsilon\}, S)$. Validate the string aaaab. 8

   b) Construct the CFG for the given PDA $M = (\{A, B\}, \{a, b\}, \{Z, X\}, \delta, A, Z, \phi)$ where δ is defined as $\{\delta(A, b, Z) = (A, XZ), \delta(A, \varepsilon, Z) = (A, \varepsilon)\ \delta(A, b, X) = (A, XX), \delta(A, a, X) = (B, X), \delta(B, b, X) = (B, \varepsilon), \delta(B, a, Z) = (A, Z)\}$. 6

   c) Define Greibach Normal Form. Convert the following grammar to GNF 6

   $G = (\{E, T, F\}, \{+, *, (,), a\}, \{E \rightarrow E + T \mid T, T \rightarrow T * F \mid F, F \rightarrow (E) \mid a\}, E)$.

MODULE – III

5. a) Construct the Turing Machine which can find out the value of $\log_2^n$ where n is stored as an unary number. 10

   b) Explain the following : 10
      i) Nondeterministic Turing Machine
      ii) Universal Turing Machine.

6. a) Construct the Turing Machine to compute the function $f(w) = ww$. 8

   b) Explain briefly the Church-Turing thesis. 2

   c) Discuss the power of Turing machine. Construct the Turing machine to compute the addition of two given binary numbers. If the input on the tape is .. B10+01B.., then the output on the tape should be ..BB11B... 10

MODULE – IV

7. a) If L_1 and L_2 are recursively enumerable languages over Σ then $L_1 \cup L_2$ and $L_1 \cap L_2$ are also recursively enumerable. 4

   b) Construct the unrestricted grammar for the following language : 4

   $L(G) = \{a^n b^n c^n d^n \mid n \geq 1\}$.

   c) Define the following : 4
      i) Non self accepting
      ii) Trio.

   d) Construct the Right Linear Grammar for the language $L(G) = \{a^n b \mid n \geq 0\} \cup \{b^n a \mid n \geq 1\}$. Convert the Right Linear Grammar to Left Linear Grammar. 8

8. a) Consider the Unrestricted Grammar with productions : 8

   $S \rightarrow aBS \mid \varepsilon$, $aB \rightarrow Ba$, $Ba \rightarrow aB$, $B \rightarrow b$. Simulate the TM.

   b) Explain the equivalence of Context Sensitive Grammar and Linear Bounded Automation. 4

   c) Construct the context-sensitive grammar for the following language : 4

   $L(G) = \{a^n b^n a^{2n} \mid n \geq 1\}$.

   d) Explain the following : 4
      i) Halting problem
      ii) Linear Bounded Automation.