29/11/14 Regular (t) Comp

COMP 5 – 2 (RC)

T.E. (Computer) (Semester – V) Examination, Nov./Dec. 2014
(Revised Syllabus in 2007-08)
AUTOMATA LANGUAGES 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 a DFA to recognize the set of strings over {a, b}* that contain the same number of occurrences of the substring ab as of the substring ba. 6

   b) Minimize the following DFA using table filling method. 6

   $M = (\{1, 2, 3, 4, 5, 6\}, \{a, b, c\}, \delta, 1, \{2, 4, 5, 6\})$ where δ is $\delta = \{\delta(1, a) = 5,$
   $\delta(1, b) = 2,\ \delta(1, c) = 2, \delta(2, a) = 1, \delta(2, b) = 6,\ \delta(2, c) = 2, \delta(3, a) = 2, \delta(3, b) = 4,$
   $\delta(3, c) = 5, \delta(4, a) = 3,\ \delta(4, b) = 6\ \delta(4, c) = 2, \delta(5, a) = 3, \delta(5, b) = 6,$
   $\delta(5, c) = 5, \delta(6, a) = 1, \delta(6, b) = 3,\ \delta(6, c) = 4\}.$

   c) Construct a Mealy Machine to add two binary numbers. Convert the Mealy Machine to equivalent Moore Machine. 8

2. a) Prove the following languages (all with input alphabet {0, 1}) are regular or not. 8
      a) Non-empty strings with the last symbol equal the first symbol.
      b) Odd-length strings with the first symbol equal the middle symbol.

   b) Construct a regular expression to represent the following DFA
   $M = (\{A, B, C, D\}, \{0, 1\}, \delta, A, \{B, D\})$ where δ is defined as

State	Input	
	0	1
A	C	B
B	D	A
C	B	C
D	A	C

   8

   c) Construct a NFA that accepts the language $L = \{a \in \{0,1\}^* \mid |a| \text{ is a multiple of } 2 \text{ or } 3\}$. 4

P.T.O.

MODULE – II

3. a) Let $\Sigma = \{0,1\}$. Consider the language NEP defined as follows :

NEP = {w ε Σ^* | w is not an even-length palindrome} Construct the CFG. Convert the CFG to PDA. 8

b) Prove the given language is not CFL.

$L = \{ww \mid w \varepsilon \{a,b\}^*\}$ 4

c) Construct NPDA for the following language over alphabet Σ.

$L = \{w_1 c w_2 \mid w_1, w_2 \varepsilon \{a,b\}^*$ and $w_1 \neq w_2^R\}$. $\Sigma = \{a,b,c\}$. 8

4. a) Construct Top-down PDA for given CFG

G = ({S},{a,b}, {S → a | aS | bSS | SSb | SbS}, S). Show the sequence of moves for input string : abbaaa. 8

b) Construct the grammar in GNF for the given language

$L = \{a^k b^m c^n \mid k,m,n, 2k \geq n\}$ 8

c) Show that context free languages are closed under

i) Union

ii) Kleene closure. 4

MODULE – III

5. a) Given an input #w#, where w is a string of a's and b's construct a Turing machine makes a copy of w and halts with #w#w# as the output. 6

b) Explain the following :

i) Church-Turing Thesis

ii) Non-deterministic Turing Machine. 4

c) Discuss the power of Turing machine. Construct a TM to divide two positive integers. Assume that the numbers are represented as a unary string of 1's. 10

6. a) Explain the Universal Turing machine. 6

b) Construct a TM that insert σ such that the tape contents are changed from yz to $y\sigma z$ where $y \varepsilon (\Sigma \cup \{\Lambda\})^*$, $\sigma \varepsilon (\Sigma \cup \{\Delta\})$, $z \varepsilon \Sigma^*$, $\Sigma = \{a,b\}$. 8

c) Design the Turing machine for the following language :
$L = \{|x|_0 \bmod 2 \text{ and } |x|_1 \equiv 0 \bmod 2 | x \varepsilon \{0, 1\}^*\}$. 6

MODULE – IV

7. a) Construct the type 0 grammar that generates the language $L = \{ww | w \varepsilon \{0, 1\}+\}$. Show the right most derivation for the string abab. (6+2)

b) Explain the following :

i) Trios and Full Trios

ii) Generalized sequential machine

iii) AFL. 6

c) Explain the equivalence of Context Sensitive grammar and Linear Bounded Automaton. 6

8. a) Construct the CSG for the following language.

$L = \{a^i b^i c^i d^{2i} | i > 0\}$. Validate the given string abcdd. 6

b) Explain the equivalence of Turing Machine and Type 0 grammar. 6

c) Construct the left linear grammar for the given regular expression $(10 + (0 + 11)0^*1)^*$. Convert left linear grammar to right linear grammar. 8