Reg. No. : | | | | | | | | | | |

Question Paper Code: 92031

M.E. DEGREE EXAMINATION, MAY 2014.

Elective

Computer Science and Engineering

01PCS502 – THEORY OF COMPUTING

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. Define non deterministic finite automaton.
2. Let R be any set of regular languages, Is U_{Ri} regular. Prove it.
3. Define a regular expression. Give example.
4. State pumping lemma for regular language.
5. Give a CFG to generate the set of all strings over alphabet {a, b} with exactly twice as many a's and b's.
6. Find the language generated by the grammar (S-> aSb, S-> ab).
7. Differentiate multitape and multitrack Turing machine.
8. Define Griebach normal form.
9. Prove that the complement of recursive language is recursive.
10. State Rice theorem and recursively enumerate index sets.

PART - B (5 x 14 = 70 Marks)

11. (a) (i) Construct a DFA for the given NFA

$M = (\{q_0, q_1, q_2, q_3\}, \{0, 1\}, \delta, q_0, \{q_3\})$, where δ is

States	Input	
	0	1
q_0	$\{q_0, q_1\}$	$\{q_0\}$
q_1	$\{q_2\}$	$\{q_1\}$
q_2	$\{q_3\}$	$\{q_3\}$
q_3	φ	$\{q_2\}$

(10)

(ii) Construct a DFA that accepts all the strings on {0, 1}. (4)

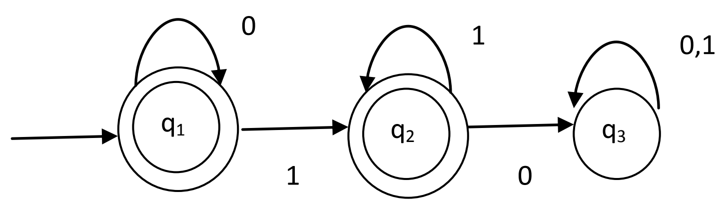
Or

(b) (i) Construct an NFA equivalent to $(0 + 1)^* (00 + 11) (0 + 1)^*$. (4)

(ii) Let L be a set accepted by an NFA. Then prove that there exists a deterministic finite automaton that accepts L. Is the converse true? Justify your answer. (10)

12. (a) (i) Show that the set (4)

(ii) Find the regular expression corresponding to the finite automaton given below. (10)



Or

(b) (i) Construct a minimum state automaton equivalent to a given automaton M whose transition table is given below. (10)

State	Input	
	a	b
q_0	q_0	q_3
q_1	q_2	q_5
q_2	q_3	q_4
q_3	q_0	q_5
q_4	q_0	q_6
q_5	q_1	q_4
q_6	q_1	q_3

(ii) Show that the regular languages are closed under intersection and reversal. (4)

13. (a) (i) If L is context-free language then prove that there exists a PDA M such that L = N (M). (10)

(ii) Let G be the grammar S-> SbS / a. For the string abababa find its leftmost derivation and derivation tree. (4)

Or

(b) (i) Convert the grammar S-> AB, A-> BS| b, B-> SA| a into Greibach normal form. (10)

(ii) Suppose G is CFG and w, of length l, is in L(G). How long is a derivation of w in G if G is in CNF and if G is in GNF? (4)

14. (a) (i) Give formal push down automata that accepts { wcw^R| w in $(0 + 1)^*$} by empty stack. (10)

(ii) Show that the following grammars are ambiguous.

{ S-> aSbS| bSaS| λ} and { S-> AB| aaB, A-> a, B-> B}. (4)

Or

(b) (i) Design a Turing machine to accept the language of all palindromes over the alphabet set {a, b}. (10)

(ii) Explain how the finite control of a Turing machine can be used to hold a finite amount of information with an example. (4)

15. (a) (i) Explain the Halting problem. Is it decidable or undecidable? (8)

(ii) Show that the characteristic function of set of all even numbers is recursive. (6)

Or

(b) (i) Show that " finding whether the given CFG is ambiguous or not" is undecidable by reduction technique. (8)

(ii) Describe how a turing machine can be encoded with 0 and 1 with an example. (6)

PART - C (1 x 10 = 10 Marks)

16. (a) Obtain the code for < M, 1011 > where M = ($\{q_1, q_2, q_3\}$, {0, 1}, {0, 1, B}, δ, Q, B, $\{q_2\}$)

Have moves

$\delta(q_1, 1) = (q_3, 0, R)$
$\delta(q_3, 1) = (q_1, 1, R)$
$\delta(q_3, 1) = (q_2, 0, R)$
$\delta(q_3, B) = (q_3, 1, L)$. (10)

Or

b) Construct a PDA accepting $L = \{a^n, b^m, a^n : m, n \geq 1$ by empty store$\}$. (10)