Reg. No. :

Question Paper Code : 51348

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2014.

Fifth Semester

Computer Science and Engineering

CS 2303/CS 53/ 10144 CS 504 — THEORY OF COMPUTATION

(Common to Seventh Semester Information Technology)

(Regulation 2008/2010)

(Common to PTCS 2303 – Theory of computation for B.E. (Part-Time) Fifth Semester Computer Science and Engineering – Regulation 2009)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is a finite automaton?

2. Enumerate the difference between DFA and NFA.

3. Construct a finite automaton for the regular expression 0*1*

4. Mention the closure properties of regular languages.

5. Construct a CFG for the language of palindrome strings over {a, b}.

6. When do you say a grammar is ambiguous?

7. State pumping Lemma for context free languages.

8. Define a turing machine.

9. When a language is said to be recursively enumerable?

10. Define the classes P and NP.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Prove the following by the principle of induction :

$$\sum_{k=1}^{n} K^2 = \frac{n(n+1)(2n+1)}{6}. \quad (8)$$

(ii) Construct a DFA that accepts all strings on {0,1} except those containing the substring 101. (8)

Or

(b) (i) Construct a non-deterministic finite automaton accepting the set of strings over {a, b} ending in *aba*. Use it to construct a DFA accepting the same set of strings. (10)

(ii) Construct NFA with $\in$ moves which accepts a language consisting the strings of any number of a's, followed by any number of b's, followed by any number of c's. (6)

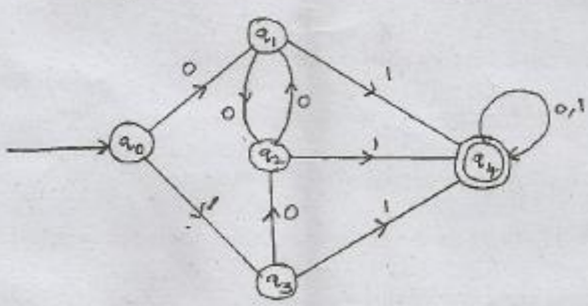
12. (a) (i) Design a finite automaton for the regular expression $(0+1)^*(00+11)(0+1^*)$. (8)

(ii) Prove that $L = \{0^{i^2} / i$ is an integer; $i \geq 1\}$ is not regular. (8)

Or

(b) (i) Prove that the class of regular sets is closed under complementation. (6)

(ii) Minimize the finite automaton shown in figure below and show both the given and the reduced one are equivalent. (10)



13. (a) (i) If G is the grammar $S \rightarrow SbS / a$ show that G is ambiguous. (6)

(ii) Let $M = (\{q_0, q_1\}, \{0,1\}, \{x, z_0\}, \delta, q_0, z_0, \phi)$ where δ is given by

$\delta(q_0, 0, z_0) = \{(q_0, xz_0)\}$

$\delta(q_1, 1, x) = \{(q_1, \in)\}$

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$\delta(q_0, 0, x) = \{(q_0, xx)\}$

$\delta(q_1, \in, x) = \{(q_1, \in)\}$

$\delta(q_0, 1, x) = \{(q_1, \in)\}$

$\delta(q_1, \in, z_0) = \{(q_1, \in)\}$.

Construct a CFG for the PDAM. (10)

Or

(b) (i) Construct a pushdown automata to accept the language $L = \{a^n b^n / n \geq 1\}$ by empty stack and by final state. (10)

(ii) Convert the grammar $S \to 0S1 / A;\ A \to 1A0 / S / \in$ into PDA that accepts the same language by empty stack. Check whether 0101 belongs to $N(M)$. (6)

14. (a) (i) Define Chomsky normal form. Find an equivalent grammar in CNF for the grammar $G = (\{S, A, B\}, \{a, b\}, P, S)$ with productions $S \to bA / aB,\ A \to bAA / aS / a;\ B \to aBB / bS / b$. (8)

(ii) Show that the Language $L = \{a^i b^i c^i / i \geq 1\}$ is not context free. (8)

Or

(b) (i) Design a Twinning machine to accept the language $L = \{0^n 1^n / n \geq 1\}$ and simulate its action on the input 0011. (12)

(ii) Write short note on checking off symbols. (4)

15. (a) Define diagonalization language. Show that the language L_d is not a recursively enumerable language. (16)

Or

(b) (i) Prove that the universal language is recursively enumerable. (10)

(ii) Define Post correspondence problem. Let $\Sigma = \{0,1\}$. Let A and B be the lists of three strings each, defined as

	List A	List B
i	w_i	x_i
1	1	111
2	10111	10
3	10	0

Does this PCP have a solution. (6)