

M.E. DEGREE EXAMINATIONS: NOVEMBER 2009

Third Semester

COMPUTER SCIENCE AND ENGINEERING

P07CSE01 Theory of Computation

Time: Three Hours**Maximum Marks: 100****Answer ALL Questions:-****PART A (10 x 2 = 20 Marks)**

1. State Kleen's theorem.
2. List out the types of grammar.
3. Write two examples for ambiguous grammar.
4. State the properties of context free language.
5. Distinguish between Deterministic Pushdown Automata and Non deterministic Pushdown Automata.
6. Define Pumping Lemma for Context free Language.
7. State Church Turing Thesis.
8. What are P and NP problems?
9. What is enumerating a language?
10. Write the Rice Theorem.

PART B (5 x 16 = 80 Marks)

11. a. Consider the two regular expressions (16)

$$r1: 0^* / 1^* \qquad r2: 01^* / 10^* / 1^*0 / (0^*1)^*$$

- (i) Find a string corresponding to r1 but not r2.
- (ii) Find a string corresponding to r2 but not r1.
- (iii) Find a string corresponding to both r1 and r2.
- (iv) Find a string in $\{0,1\}^*$ corresponding to neither r1 not r2.

(OR)

- b. Write an algorithm for converting NFA to DFA and explain the algorithm using one example. (16)

12. a. consider the grammar with the following productions (16)

$$S \rightarrow iCtS / iCtSeS / a \qquad C \rightarrow b$$

- (i) Generate a sentence 'ibtibtaea' using leftmost and rightmost derivation.

- (ii) Construct a derivation tree for the above sentence and check for ambiguity using tree.
- (iii) Derive an equivalent Chomsky Normal form production

(OR)

b. (i). Write a note on normal forms for context free grammar. (8)

(ii). Consider the grammar with productions (8)

$$S \rightarrow abB \quad A \rightarrow aaBb / \epsilon \quad B \rightarrow bbA$$

Is context free or not? What language does this grammar generate?

13.a.(i). Define Pushdown Automata. Explain the construction of PDA using an example. (8)

(ii). Construct the pushdown automata for the set of balanced strings of parentheses []. (8)

(OR)

b. Construct Pushdown Automata (PDA) to recognize the languages generated in the following grammar: (16)

$$S1 \rightarrow S1 + T / T \quad T \rightarrow T * F / F \quad F \rightarrow (S1) / a$$

Show the sequence of moves for the string $(a+a*a)$ and $a+a*a$.

14.a. Design a Turing machine with no more than three states that accepts the language $L(a(a+b)^*)$. Assume that $\Sigma = \{a,b\}$. Is it possible to do with a two state machine? Is it possible to do this with a two state machine? Trace for a string of acceptance and non-acceptance. (16)

(OR)

b. Draw a transition diagram for a Turing machine accepting each of the following languages and trace out the moves for any string. (16)

(i). $\{a^n b^n c^n / n > 0\}$

(ii). The language of balanced strings of two kinds of parenthesis () and { }.

15.a.(i). Show that a language $L \subseteq \Sigma^*$ is recursively enumerable if and only if L can be enumerated by some Turing Machine. (10)

(ii). Explain halting problem. (6)

(OR)

b.(i). State the post correspondence problem with an example. (8)

(ii). Write down the decidable property of a language. (8)
