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

Question Paper Code : 52868

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY, 2019.

Fifth/Eighth Semester

Computer Science and Engineering

CS 6503 — THEORY OF COMPUTATION

(Common to Information Technology)

(Regulation 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Construct Finite Automata for the regular expression : $(a \mid b)^* abb$.
2. Prove that $L = \{0^n 1^n \mid n >= 1\}$ is not a regular language.
3. What is ambiguous grammar? Give example.
4. Find an unambiguous grammar for the following grammar :
   $E \rightarrow E + E \mid E * E \mid (E) \mid id$.
5. Define Push Down Automata (PDA).
6. What is meant by Instantaneous Description for a PDA.
7. What is recursive enumerable language? Give example.
8. Write the applications of Turing Machine.
9. What is unsolvable problem? Give example.
10. What is Primitive Recursive Function? Give example.

PART B — (5 × 13 = 65 marks)

11. (a) Construct E-NFA for the regular expression (01 | 10) *101 and convert it into DFA. (13)

Or

(b) Elaborate the steps to convert the DFA into Regular expression with suitable example. (13)

12. (a) (i) Convert the following CFG into Griebach Normal Form: (10)

$X_1 \rightarrow X_2X_3$
$X_2 \rightarrow X_3X_1 \mid b$
$X_3 \rightarrow X_1X_2 \mid a$

(ii) Remove $\in$ - production from the following grammar

$S \rightarrow ASA \mid aB \mid b, A \rightarrow B, B \rightarrow b \mid \in$. (3)

Or

(b) (i) Write short notes on Chomsky hierarchy of grammar. (5)

(ii) Convert the following grammar in to CNF: (5)

$S \rightarrow bA \mid aB$
$A \rightarrow bAA \mid aS \mid a$
$B \rightarrow aBB \mid bS \mid b$

(iii) Eliminate left recursion for the following grammar : (3)

$A \rightarrow A+B \mid A*B \mid B \mid a$

13. (a) (i) Construct PDA for $L = \{a^n b^n \mid n >= 0\}$. (6)

(ii) Construct PDA for $L = \{w \in (a \mid b)^* \mid$ where 'w' is a PALINDROME$\}$. (7)

Or

(b) (i) Construct PDA for $L = \{0^n\ 1^m\ 2^{n+m} \mid$ where $n, m >= 1\}$. (6)

(ii) Illustrate the equivalence between PDA and CFL with example. (7)

14. (a) Discuss about the techniques for constructing the various types of Turing Machine. (13)

Or

(b) (i) Construct Turing Machine for
$L = \{w\varepsilon\ (a \mid b)^* \mid$ where 'w' is a PALINDROME$\}$. (8)

(ii) Construct Turing Machine for $L = \{1^n\ 2^n\ 3^n \mid$ where $n >= 1\}$. (5)

15. (a) (i) Explain in detail about the various properties of recursive and recursive enumerable languages. (8)

(ii) How does a primitive recursive function help to identify computable function. (5)

Or

(b) Describe in detail about NP-Hard and NP-Complete problems with example. (13)

PART C — (1 × 15 = 15 marks)

16. (a) (i) Construct Turing machine for language over the input alphabet $\Sigma = \{a, b\}$ to shift the input symbol two positions left. (5)

(ii) Analyze and brief the concept of tractable and intractable problems. (10)

Or

(b) (i) State and prove the pumping lemma for CFL. (7)

(ii) Write an algorithm for minimization of DFA. (8)