[No. of Printed Pages – 4]

1535

CSE204
[ET]

Enrol. No. .....

END SEMESTER EXAMINATION : APRIL-MAY, 2024

THEORY OF COMPUTATION

Time : 3 Hrs. *Maximum Marks : 60*

Note: ***Attempt questions from all sections as directed.***

SECTION – A (24 Marks)

Attempt any **four** *questions out of* **five.**
Each question carries **06** *marks.*

1. Design a pushdown automaton to recognize the language of all ODD length palindromes over the alphabet {a, b}.

2. (a) Design a deterministic finite automaton (DFA) to recognize the language of strings over {a, b} containing atleast one a's and exactly two b's.

(2)

P.T.O.

(b) Define finite automata with output. Differentiate between Mealy and Moore machine in terms of relationship between the length of input string and output string? (2)

(c) Briefly explain the turing test also known as the 'imitation game'. (2)

3. (a) Design a Push-down automata (PDA) for the language $L=\{a^n b^m a^n \mid m,n>=1\}$ (3)

(b) What is an ambiguous grammar? Provide an example and explain why ambiguity is undesirable. (3)

4. (a) Design a turing machine to implement addition of two numbers. (3)

(b) Differentiate between recursive and recursively enumerable languages, providing examples of each. (3)

5. State pumping lemma for context free language (CFL). Check whether the following language is context free language or not? $L = \{a^n b^m c^n d^m \mid n \geq 1, m \geq 1\}$

SECTION – B (20 Marks)

Attempt any **two** *questions out of* **three.**
Each question carries **10** *marks.*

6. (a) What do mean by PCP amd MPCP problem? Explain with the help of suitable examples. (5)

   (b) Explain why the Halting Problem is undecidable. Discuss the implications of the undecidability of the Halting Problem in computer science. (5)

7. (a) Explain Griebach normal form (GNF). Convert the following Context free grammar (CFG) into GNF

   $E \rightarrow E+T \mid T \quad T \rightarrow T \times F \mid F \quad F \rightarrow id$ (7)

   (b) Design a Finite Automata over {a,b} for the given Regular Expression [ab + (b + aa)b* a]. (3)

8. (a) Justify which of the following language L1, L2 or L3 is (are) Regular or Deterministic Cotext free language (CFL) or Non- deterministic context free language (NCFL).

   $L1 = \{a^n b^m c^m d^n \mid n \geq 1, m \geq 1\}$ $L2 = \{ww^R \mid w \in \{a,b\}^*$ *and* w^R *is a reverse of* $w\}$ $L3 = \{a^i b^j c^k \mid i \geq 0, j \geq 1, k \geq 1\}$ (6)

P.T.O.

(b) Find the Regular expression (RE) for the language which accepts set of all strings, in which number of a's are divisible by 3 over the alphabets {a, b} (4)

SECTION – C (16 Marks)

(Compulsory)

9. (a) Construct a turing machine over {a,b} which accepts the following language:

$L = \{wcw^R \mid w \in \{a,b\}^* \text{ and } w^R \text{ is a reverse of } w\}$ (6)

(b) Explore the relationship between primitive recursive functions, recursive functions, and computability theory using suitable example. (4)

(c) Contruct a reduced equivalent grammar G' to the given grammar G:

S -> aAa
A -> Sb | bCC | DaA
C -> abb | DD
E -> aC
D -> aDA

(3)

(d) M = ({q1, q2, q3}, {0, 1}, δ, q1, {q3}) is a non-deterministic finite automata where δ is given by: δ(q1, 0) ={q2, q3} δ(q1, 1)= {q1} δ(q2, 0)={q1,q2} δ(q2, 1) = Φ δ(q3, 0) = {q2} δ(q3, 1) = {q1, q2} Construct the equivalent deterministic finite automata. (3)