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CSE204
[ET]

Enrol. No. .....

END SEMESTER EXAMINATION : April-May, 2023

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. (a) What do you understand by "Undecidability Problem" in the context of Turing Machines? Explain using suitable examples. (3)

(b) If $w \in L(G)$ and $|w| = k$, where G is in (i) Chomsky normal form, (ii) Greibach normal form, What can you say about the number of steps in the derivation of w? (3)

2. (a) Elaborate upon the differences between Recursive Set and Recursively enumerable set. Use suitable examples. (3)

(b) Constract a grammar G which generates all the even integers upto 998. (3)

P.T.O.

3. (a) Design a turing machine to compute the function F(w) = wR, such that w belongs to {0,1}+. (3)

(b) What do you understand by Parsing? How Top-down parsing is different from Bottom-up Parsing? Explain with suitable example. (3)

4. What do you understand by Initial functions for natural numbers? Also throw some light on zero function, projection function and composition function.

5. 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 automa.

SECTION – B (20 Marks)

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

6. (a) What shall be the regular expression for representing the set L of strings in which every 0 is immediately followed by atleast two 1's. Prove that regular expression r = ∧ + 1*(011)*(1*(011 *)* also describes the same set of strings. (5)

(b) What do you understand by Ambiguity of a given grammar. Show that the given grammar is ambiguous :

S -> aB | ab A -> aAB | a B -> ABb | b (5)

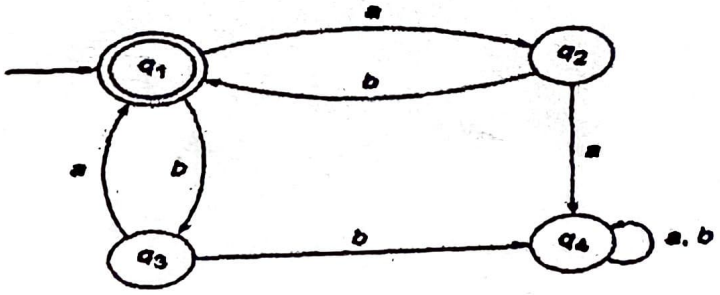
7. (a) Prove that the finite automaton whose transition diagram is given below accepts the set of all strings over alphabet {a, b} with an equal number of a's and b's, such that each prefix has atmost one more a than b's and atmost one more b than the a's. (5)

(b) Contract a reduced equivalent grammar G' to the given grammar G :

S -> aAa A -> Sb | bCC | DaA

C-> abb | DD E -> aC D -> aDA (5)

8. State and prove Arden's theorem that is generally taken into consideration for computing the regular expression. Further Construct a regular expression corresponding to the state diagram described as under :



P.T.O.

SECTION – C (16 Marks)

(Compulsory)

9 (a) Let x and y be two positive integers represented in unary notation. Construct a turing machine that will halt in final state qy if x >= y and that will halt for non-final state qn if x < y. More precisely, the machine is to perform the computation: q0w(x)0w(y) |- * qyw(x)0w(y) : if x>=y q0w(x)0w(y) |- * qnw(x)0w(y): if x<y (3)

(b) Design a Push Down Automata accepting the set of all even-length palindromes over {a, b} by the empty store. (4)

(c) Elaborate upon how Chomsky classified the various forms of language using suitable examples. Further discuss the applications of different types of grammar. (3)

(d) What do mean by PCP and MPCP problem? Explain with the help of suitable examples. (6)