Paper / Subject Code: 40725 / Discrete Structures & Automata Theory "ECS" Dec'2023

SE SemIV (R-2019 Cscheme)

19/12/2023

Duration: 3hrs **[Max Marks:80]**

N.B. : (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required and state it clearly.

1 Attempt **any FOUR** [20]

a Differentiate between Mealy and Moore Machine. [05]

b Prove by Mathematical Induction $n^3 + 2n$ is divisible by 3 for n>=1 [05]

c Let R be a relation on set of real numbers such that aRb , if and only if a - b is an integer. Prove that R is an Equivalence Relation. [05]

d Find the Leftmost derivation, rightmost derivation, Parse Tree from the input string id+ id * id from the following grammar. [05]
E → E + E
E → E * E
E → id

e Draw an NFA with ε moves ,for the regular expression r = a . (a + b)* , which represent the language consisting of strings a's & b's starting with a. [05]

2 a Define and give the Example of Injective, Surjective & Bijective function. Check the Injectivity and Surjectivity for the following function. [10]
f: N → N given by $f(x) = x^2$

b Consider a set A = {1,2,3,4,12} & the relation of divisibility ie aRb if a divides b which denote a | b. Show that (A,R) is Poset. Construct Poset and also Draw Hasse Diagram. [10]

3 a Define with example Euler path, Euler circuit, Hamiltonian path, and Hamiltonian circuit. [10]

b Obtain Disjunctive Normal Form of $p \wedge (p \rightarrow q)$ [05]

c Prove that Statement $(p \rightarrow q) \leftrightarrow (\sim q \rightarrow \sim p)$ is a tautology. [05]

4 a Construct a Mealy machine that accept the string ending in '00' and '11'. convert the same to Moore Machine. [10]

b Write a short notes on Types of Grammar. [10]

a Design a finite automaton to check divisibility by 3 to binary number. [10]

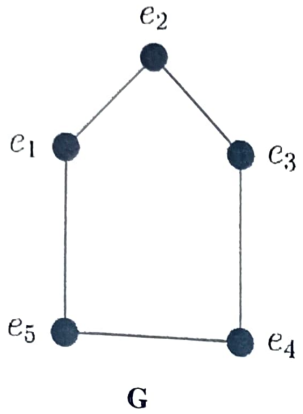
b Differentiate between NFA and DFA. [05]

c Define regular expression and Describe it's any two properties. [05]

6 a Design PDA to check odd palindrome over $\Sigma = \{0,1\}$. [10]

b Define Isomorphic Graph and state the condition of Graph Isomorphism. [10]

Determine whether the following Graphs are Isomorphic.



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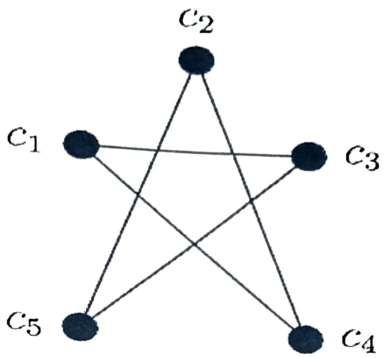

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