Sub Code:CS302

Paper Id: 230151 Roll No:

B. TECH.

(SEM-III) THEORY EXAMINATION 2019-20

DISCRETE STRUCTURES

Time: 3 Hours *Total Marks: 100*

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION – A

1. **You are required to answer all the parts of this question.** **2×10=20**
   (a) Define power set.
   (b) Find $A \triangle B \; if \; A = \{1,2,5\}, B = \{3,4,5,8\}$
   (c) What is order of an element in a Group?
   (d) Define Ring.
   (e) In an integral domain D, show that if xy = xz with x≠0 then y=z.
   (f) In any Boolean algebra, show that (a + b). (a ′ + c) = a ′. b + ac + bc
   (g) Define quantifiers.
   (h) Draw truthtable of proposition$p \vee \backsim p$.
   (i) Explain conditional proposition.
   (j) What is Hamiltonian cycle?

SECTION – B

2. **Attempt any three parts of the following:** **10×3=30**
   (a) What are ordered pair and Cartesian product? Prove that
   $$A \times (B \cap C) = (A \times B) \cap (A \times C)$$
   (b) Explain Groupoid and Monoid with necessary conditions and example.
   (c) How are sequential circuits different from combinational circuits? Draw the logic circuit corresponding to Boolean expression Y = A + BC + B.
   (d) Prove that the following propositions are tautology
   i. $\backsim (p \wedge q) \vee q$
   ii. $p \rightarrow (p \vee q)$
   (e) Solve the following recurrence relation:
   i. $a_n + a_{n-1} = 3n2^n$
   ii. $a_n = 2a_{n-1} + 3^n, n \geq 1 and \; a_0 = 1$ (by iterative method)

SECTION – C

3. **Attempt any one part of the following:** **10×1=10**
   (a) What is recursion? Explain any recursively defined function with suitable example.
   (b) What is closure of relation? Explain Symmetric and transitive closure in detail.

4. **Attempt any one part of the following:** **10×1=10**
   (a) Prove that inverse of each element in a group is unique.
   (b) Let $G = (1, -1, i, -i\}$ with the binary multiplication be an algebraic structure, where $i^2 = -1$,
      (i) Determine whether G is an Abelian
      (ii) If G is cyclic group, then determine the generator of G

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5. Attempt any one part of the following: 10×1=10

(a) Draw hasse diagram for divisibility relation on following set $A = \{3, 4, 12, 24, 48, 72\}$

(b) Simplify the following Boolean functions using three variable maps
F(x,y,z)=∑(0,1,5,7)
F(x,y,z)=∑(1,2,3,6,7)

6. Attempt any one part of the following: 10×1=10

(a) Prove by mathematical Induction
   i. $6^{n+2} + 7^{2n+2}$ is divisible by 43 for every positive integer n.
   ii. $n! \geq 2^{n-1}$ for $n \geq 1$

(b) What is normal form? Find principal disjunctive normal form of
   i. $p \rightarrow q$
   ii. $q \vee (p \vee \sim q)$

7. Attempt any one part of the following: 10×1=10

(a) Determine the GF of a numeric function a_r where

$$a_r = \begin{cases} 2^r \ if \ r \ is \ even \\ -2^r \ if \ r \ is \ odd \end{cases}$$

(b) Explain the following:
   i. Directed Graph
   ii. Weighted Graph
   iii. Bipartite Graph
   iv. Null Graph
   v. Complete Graph

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