KADI SARVA VISHWAVIDYALAYA
B.E 3rd SEMESTER EXAMINATION (April 2024)
SUBJECT: Discrete Mathematics (Code: CC302B N)

Date: 30/04/2024   Time: 3 hour   Marks: 70

Instruction:
1. Answer each section in separate Answer Sheet.
2. Use of scientific Calculator is permitted.
3. All questions are compulsory.
4. Indicate clearly, the option you attempted along with its respective question number.
5. Use the last page of main supplementary for rough work.

Section:1

Q.1 (a) A relation is define on set $\mathbb{Z}$ is $R = \left\{ (x,y) / \ x - y \ \text{divided by} \ 7 \right\}$ then check that R is equivalence relation or not. [05]

(b) Draw the Hasse Diagram for the following POSETs and Where D is the Division Relation. [05]
    (i) $< S_6, D >$ (ii) $< S_{12}, D >$

(c) Show that fourth root of unity form a group under multiplication. [05]

OR

(c) Let p, q and r be the statement then construct the truth table for the statement formula A, $A : (\sim p \wedge q) \to r$. [05]
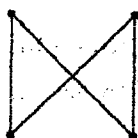
Q.2 (a) Prove that $\langle \{1, 3, 3^2, 3^3, 3^4, ...\}, D \rangle$ is are poset and chain. [05]

(b) Let S be the set of all integers from 10 to 99 which are neither divisible by 3 nor divisible by 5 then find number of elements in S. [05]

OR

Q.2 (a) Prove that (S_3, o) is non-abelian permutation group. [05]

(b) Prove that the pair of the graphs are isomorphic [05]

Q.3 (a) Show that $\langle S_{30}, D \rangle$ is lattice.

(b) Define following terms with graph

    (i) Tree
    (ii) Rooted tree
    (iii) Forest tree

OR

Q.3 (a) Show that $\langle \mathbb{N}, \leq \rangle$ is Poset. where relation " $\leq$ " is smaller or equal. [05]

(b) If p and q are any two statement then verify, $\sim (p \leftrightarrow q) = \sim p \leftrightarrow q = p \leftrightarrow \sim q$. [05]

Section:2

Q.4 (a) Prove that the set $\langle G = \{0,1,2,3,4,5\}, +_6\rangle$ is an abelian group.   [05]

(b) Prove that Sub group $H = \{-1,1\}$ is normal subgroup for the group [05]
$\langle G = \{1,-1,i,-i\}, \times\rangle$.

(c) Define the following terms with example and truth table .   [05]
(i) Negation   (ii) Conjunction   (iii) Disjunction

OR

(c) Define the following terms for Undirected graphs with example.   [05]
(i) Closed and open walk   (iv) Path
(ii) Loop   (v) Walk.
(iii) Simple Graph

Q.5 (a) Let $R = \{(1,1),(1,2),(1,3),(1,4),(2,3),(3,3),(2,2),(3,2),(3,4),(4,4),(4,1),$ [05]
$(4,3)\}$ be the relation define on set $A = \{1,2,3,4\}$ then find the matrix
for relation R, draw its diagraph and also find in-degree and out-
degree.

(b) Find the number of positive integers ≤ 200 and divisible by 2 or 5. [05]
Using set theoretical argument and venn diagram

OR

Q.5 (a) Show that $\langle S_{30}, *, \oplus, 0, 1, ' \rangle$ is boolean algebra.   [05]

(b) Define Join Irreducible and Meet Irreducible. Find the Join Irreducible,
Meet Irreducible, Atom, and Antiatom of the Lattice $\langle S_{70}, D\rangle$,   [05]
where $S_{70} = \{1,2,5,10,14,35,70\}$.

Q.6 (a) Define lattice as poset and Prove that $< P(A), \leq >$ is lattice for [05]
$A = \{a,b\}$.

(b) Define the following terms of Directed graph with example.   [05]
(i) Directed graph (ii) Isolated and Pendant vertex. (iii) Incident and
adjacent relation (iv) In degree and Out degree (v)Multiple edges.

OR

Q.6 (a) Expressed the boolean expression $x_1 * x_2$ in an equivalent sum of [05]
products canonical form of three variable.

(b) Let $f : \mathbb{Z} \longrightarrow \mathbb{Z}$ be define by $f(x) = 3x + 4$. Then check that f is [05]
one-one and onto.

✳✳✳✳✳✳

Exam No.: