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MCA 2nd Semester Examination

Discrete Mathematics (NS)

MCA-203

Time : 3 Hours **Max. Marks : 60**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all selecting one question from each of sections A, B, C and D. Question 9 in Section E is compulsory. All questions carry equal marks.

SECTION - A

1. (a) Prove that $(\sim p \vee q) \wedge (p \wedge \sim q)$ is a contradiction.

   (b) Give reason in support of your answer, decide if the two composite statements given below are equivalent statements:

   (i) If Dinesh is 18 year old, then he has a right to vote.

   (ii) Dinesh is not 18 year old, or he has a right to vote. (12)

2. (a) Define a tautology and prove that the statement $\left[(p \Rightarrow q) \wedge (q \Rightarrow r)\right] \Rightarrow (p \Rightarrow r)$ is a tautology.

   (b) What do you understand by a statement and formula? Describe axioms and rules of well-formed sequences and formulae. (12)

SECTION - B

3. (a) State and prove De'Morgan's laws of Boolean algebra.

(b) Show that $\left[(x' \wedge y')' \vee z\right] \wedge (xyz)' = x' \wedge z'$. (12)

4. (a) Define a lattice. Give examples of lattice and a set which is not a lattice.

(b) Let B = {a.b} and let operations (+) and (·) be defined as:

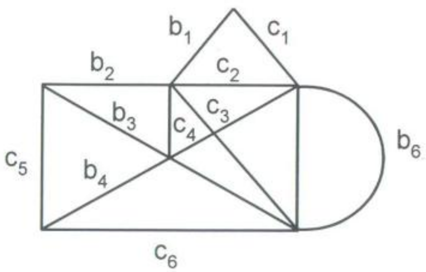
+	a	b
a	a	b
a	b	b

.	a	b
a	a	a
b	a	b

Show that (B, + ·) is a Boolean algebra (12)

SECTION - C

5. (a) Define a spanning tree. Find the minimum spanning tree at a distance of four from the spanning tree (b_1, b_2, b_3, b_4, b_5, b_6) for the graph



List all the fundamental circuits with respect to new graph.

(b) What do you mean by binary search trees? How a binary tree can be represented in the memory? Discuss one of the methods with the help of an example. (12)

6. (a) Prove that there is always a Hamiltonian path in a directed complete graph.

(b) Prove that every circuit has an even number of edges in common with every Cut-set. (12)

SECTION - D

7. (a) State and prove Lagrange's theorem on groups.

(b) Solve the recurrence relation $a_r - 5a_{r-1} + 6a_{r-1} = r + 2^r$, $r \geq 2$ with boundary conditions $a_0 = 1$ and $a_1 = 1$. (12)

8. (a) Define a group and prove that the set of integers is an abelian group of infinite order under addition.

(b) Solve the recurrence relation $a_r - 4a_{r-1} + 4a_{r-2} = 2r + 2^r$, $r \geq 2$ with boundary conditions $a_0 = 1$ and $a_1 = 1$. (12)

SECTION - E

9. (a) Define an ideal and integral domain

(b) Difference between relation and function.

(c) Define a contradiction and give an example of contradiction.

(d) Explain the Hasse's diagram.

(e) Define Boolean functions and Boolean expressions.

(f) Explain planner and non-planner graph. (2×6=12)