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(2063)

825

B.Tech 4th Semester Examination

Discrete Structures

CS-4002

Time : 3 Hours

Max. Marks : 100

*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 from each of the Sections A, B, C & D. Section E is compulsory.

**SECTION - A**

1. (a) If A and B are two sets, prove that (10)  
 $A - B = A - (A \cap B)$

(b) Prove that the following are true for sets A and B.

$$(A \cup B) \cap (\overline{A \cap B}) = (A \cap \overline{B}) \cup (B \cap \overline{A}) \quad (10)$$

2. (a) Let  $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$ ,  $A = \{1, 2, 4, 5\}$ ,  $B = \{4, 5, 6, 7\}$ ,  $C = \{1, 4, 6\}$ .  
Compute: (i)  $A \cap B$ , (ii)  $A - B$ ,  
(iii)  $A \cap (B \cup C)$ , (iv)  $\neg A \cup \neg C$ . (10)

(b) Define equivalence relation. If R and S are equivalence relations on a set A, then show that  $R \cap S$  is an equivalence relation. (10)

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[P.T.O.]

**SECTION - B**

3. (a) Given the prepositional statement:  
 $(\neg p \wedge \neg(p \Rightarrow q))$ . Construct a truth table  
 for the statement and state whether it is  
 a tautology or not. (10)
- (b) Let  $A = \{1, 2, 3, 4, 5, 6, 7\}$  and  $B = \{1, 3, 5\}$ . Give  $(A \cap B) \times B$ . (10)
4. (a) Prove that for any three propositions  
 $p, q, r$   
 $[(p \vee q) \rightarrow r] \leftrightarrow [(p \rightarrow r) \wedge (q \rightarrow r)]$  is a  
 tautology. (10)
- (b) Explain CNF and DNF in detail with the  
 help of suitable examples. (10)

**SECTION - C**

5. (a) Write note on:  
 i. Isomorphic graphs  
 ii. Semi groups (10)
- (b) Let  $T$  be a tree. Suppose we add two  
 edges to  $T$  forming a graph  $T$ . How many  
 cycles can  $T$  have? Explain in detail. (10)
6. (a) What is bipartite graph? Argue that every  
 cycle in a bipartite graph contains an even  
 number of edges. (10)
- (b) Prove that for every connected graph,  $G$ .  
 if  $G$  has no cycles, then for every pair of  
 vertices  $a$  and  $b$  in  $G$ , there is only one  
 path from  $a$  to  $b$  in  $G$ . (10)

**SECTION - D**

7. (a) Define a binary tree. Show that a tree with  $n$  vertices has  $n - 1$  edges. (10)
- (b) Prove that a finite connected graph  $G$  is Eulerian if and only if each vertex has even degree. (10)
8. (a) Show that the maximum number of vertices in a binary tree of height  $h$  is  $2^{h+1} - 1$ . (10)
- (b) Define spanning tree. Write the Kruskal's algorithm to find a minimal spanning tree of a weighted graph. (10)

**SECTION - E**

9. (a) Prove that for any 3 sets  $A$ ,  $B$  and  $C$ ,  $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$ .
- (b) List all partitions of the set  $\{1, 2\}$ .
- (c) Define asymmetric relation with an example.
- (d) Prove that  $\overline{A \cap B} = \overline{A} \cup \overline{B}$ .
- (e) Define complete graph and give an example.
- (f) Let  $A = \{1, 2, 3\}$ , find  $A \times A$ .

[P.T.O.]

- (g) If P and Q stand for the statement  
P : It is hot  
Q : It is humid  
Then what does the statement  $(P \wedge \neg Q)$   
mean?
- (h) Explain postorder traversal of a binary  
tree.
- (i) List applications of weighted graphs in  
computer science.
- (j) Write short note on propositional calculus.

**(2×10)**