[Total No. of Questions - 9] [Total No. of Printed Pages - 4]
(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 $A-B = A-(A \cap B)$ **(10)**

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

   $$(A \cup B) \cap \left(\overline{A \cap B}\right) = \left(A \cap \overline{B}\right) \cup (B \cap \overline{A})$$ **(10)**

2. (a) Let U = {l, 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) $-A \cup -C$. **(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)**

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×A.

(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 prepositional calculus.

(2×10)