14680
B. Tech 4th Semester Examination
Discrete Structures (O.S.)
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, B and C are three non-empty sets, prove that A-(B∪C) = (A-B)∩(A-C).

(b) Let U = {1, 2, 3, 4, 5, 6, 7, 8, 9}, A = {1, 2, 3, 7}, B = {4, 5, 6, 7}, C {1,3, 6}. Compute: (i) A ∩ B, (ii) A-B, (iii) A ∩ (B ∪ C), (iv) ~A ∪ ~C.

2. (a) List the members of sets A={x | x is a prime number between 10 and 20} and B={x | x=3k+2 where k is an integer and 2<k<8}. Find A-B.

(b) State and explain two De Morgan laws using suitable examples.

SECTION - B

3. (a) Show that p ⇔ q and ~p ⇔ ~q are equivalent.

(b) Let A = {1, 2, 3, 4, 5, 6, 7} and B = {1, 3, 5}. Give A ⊕ B.

14680/550

[P.T.O.]
4. (a) Define tautology. Prove that for any proposition p, q, r the compound proposition \([(p \rightarrow q) \land (q \rightarrow r)] \rightarrow (p \rightarrow r)\) is a tautology. (10)

(b) If \(R_1\) and \(R_2\) are equivalence relations on a set \(X\) then prove that \(R_1 \cap R_2\) is an equivalence relation. Give a counter example to show that \(R_1 \cup R_2\) need not be an equivalence relation. (10)

SECTION - C

5. (a) Prove that the intersection of any two subgroups of a group \(G\) is again a subgroup of \(G\). (10)

(b) What is adjacency matrix? How will you draw adjacency matrix for a given undirected graph? Give example. (10)

6. (a) Let \(T\) be a tree. Prove that removing any edge from \(T\) produces a graph, \(T'\) that is not connected. (10)

(b) Write note on:
   (i) Homographic graphs
   (ii) Recurrence relation (10)

SECTION - D

7. (a) Show that maximum number of edges in a simple graph with \(n\) vertices is \(\frac{n(n - 1)}{2}\). (10)

(b) Given \(A = \{1, 2, 3, 4, 5\}\) and \(B = \{1, 3, 5\}\). Let \(R\) be the relation from \(A \rightarrow B\) define by “\(x\) is greater than \(y\)”. Write relation \(R\), its matrix and draw its graph. (10)

8. (a) State and prove the condition to find out if a given graph is an Euler graph. (10)

(b) Define spanning tree. Write the Prim’s algorithm to find a minimal spanning tree of a weighted graph. (10)
SECTION - E

9. (a) List all partitions of the set \{a, b, c\}.

(b) Prove that for any 3 sets A, B and C, \(A \cap (B \cup C) = (A \cap B) \cup (A \cap C)\).

(c) Define symmetric relation with an example.

(d) Prove that \(\overline{A \cup B} = \overline{A} \cap \overline{B}\).

(e) When is a simple graph G bipartite? Give an example.

(f) Let A and B be sets. Prove that \((A-B) \cap (B-A) = \emptyset\).

(g) Let \(A = \{a, b, c\}\), find \(A \times A\).

(h) Define propositional calculus.

(i) Explain preorder traversal of a binary tree.

(j) How do you represent graphs inside computer? Explain.

(2\times10=20)