[Total No. of Questions - 9] [Total No. of Printed Pages - 3]
(2125)

15098

B. Tech 4th Semester Examination

Discrete Structure (OS)

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 question each from sections A, B, C and D. Section - E is compulsory.

SECTION - A

1. (a) Define Symmetric difference. Argue that the symmetric difference operator does, or does not, always satisfy the associative property. (10)

   (b) Let A be a set of non-zero rational numbers. For a, b $\in$ A, define a R b if a/b is an integer. Prove that R is reflexive and transitive but not symmetric, anti-symmetric, or asymmetric. (10)

2. (a) Prove the following statement: If R is reflexive and if S is universal relation then R o S = S. (10)

   (b) What is relation? Define the concept of equivalence relation. Give at least two examples of equivalence relation. (10)

SECTION - B

3. (a) For each statement below, say whether it is a tautology, a contradiction or a contingent statement? Prove your answer using truth tables.

   $((\neg r \Rightarrow \neg p \wedge \neg q) \vee s) \Leftrightarrow (p \vee q \Rightarrow r \vee s)$ (10)

[P.T.O.]

   (b) Define two basic counting principles. How many three digits numbers are there which are even and have no repeated digits? (Using all digits 0 through 9) (10)

4. (a) Determine whether each of the following inferences is valid or invalid. If the inference is valid, produce some evidence which will confirm its validity. If the inference is invalid, produce a combination of the truth values that will confirm a fallacy, or indicate a fallacy.

   (i) The days are becoming longer.
   The nights are becoming shorter if the days are becoming longer.
   Hence, the nights are becoming shorter.

   (ii) AB is parallel EF or CD is parallel to EF.
   AB is parallel to EF.
   Hence CD is not parallel to EF. (15)

   (b) Define the principle of Inclusion — Exclusion used in counting. (5)

SECTION - C

5. What is recurrence relation? Solve the recurrence relation.
   $a_n - 7a_{n-1} + 10a_{n-2} = 0$ for $n \geq 2$ (20)

6. What is Coset? State and prove Lagrange's theorem. (20)

SECTION - D

7. (a) Define graph. Let G have n vertices. If complement (G) is a connected graph, what is the maximum number of edges that G can have? (10)

   (b) Prove or disprove the followings:

   (i) Use the contradiction method to prove that every simple undirected graph contains two vertices having the same degree.

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(ii) A connected graph has a Euler circuit if it can be decomposed to a set of elementary cycles that have no edge in common. (10)

8. (a) Prove that any graph with n vertices and m edges has at least m-n+1 cycles. (10)

(b) Give and prove Euler's formula for planar graphs. (10)

SECTION - E

9. (i) Explain duality principle used in set theory with suitable example.

(ii) What is binary tree? Explain Inorder, preorder and postorder traversal of Binary tree.

(iii) What is group? What is a cyclic group? Explain with examples.

(iv) Show that the edges of a k-chromatic graph can be oriented so that the resulting graph has a longest directed path of length k-1. (5×4=20)

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