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B. Tech 3rd Semester Examination

Discrete Mathematics & Logic Design (N.S.)

NS-206-A

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 : Candidate are required to attempt five questions in all selecting one question from each of the section A, B, C & D and all subpart of Section E. Use of non-programmable calculators are allowed.

SECTION - A

1. (a) State and prove De Morgan's Laws.   **(4)**

   (b) What is Venn Diagrams? Draw the Venn Diagrams for various set operations.   **(10)**

   (c) Let A = {4, 6, 8, 10} and

        R = {(4, 4), (4, 10), (6, 6), (6,8), (8, 10)} is a relation on set A. Determine transitive closure of R.   **(6)**

2. (a) Prove that if f : x $\rightarrow$ y and g: y $\rightarrow$ z be two one-to-one onto function then gof is also one-to-one onto function.   **(8)**

   (b) Consider the set A={4, 5, 6, 7}. Let R be the relation $\leq$ on A. Draw the directed graph and Hasse diagram of R. **(8)**

   (c) Prove that if L be a lattice then $a \wedge b = 1$, if and only if $A \vee b = b$.   **(4)**

SECTION - B

3. (a) What is proposition, combination of propositions and fundamental equivalence of propositions? Discuss with help of examples. **(10)**

   (b) Prove that the argument $(p \wedge q) \to r$, $p \to q / -p \to ((p \wedge q) \wedge r)$ is valid without using truth table and also using truth table. **(10)**

4. (a) Prove that the number of different permutations of n distinct objects taken r at a time, $r \leq 4$ is given by

$$^nP_r = \frac{n!}{(n-r)!} = n(n-1)(n-2).....(n-r+1)$$ **(6)**

   (b) Determine the value of the followings:

   (i) $^4P_2$ (ii) $^9P_3$ (iii) $^{52}P_4$ **(6)**

   (c) What is recurrence relation? Find the particular solution of the difference equation

   $a_{r+2} - 3a_{r+1} + 2a_r = Z^r$, where z is some constant. **(8)**

SECTION - C

5. (a) What is binary operations? Discuss about properties of binary operations using suitable examples. **(10)**

   (b) let (A,*) be semi-group. Show that for a, b, c in A, if a*c=c*a and b*c=c*b, then (a*b)*c=c*(a*b). **(6)**

   (c) Show that the identity element in a group is unique. **(4)**

6. (a) What is group? Discuss various type of group using suitable examples. **(10)**

   (b) What is Ring and its types? Also consider a ring (R, +,*) defined by a*a=a. Determine whether the ring is commutative or not. **(10)**

SECTION - D

7. (a) Discuss about graph and its types.   **(10)**

     (b) Let G = {{a, b, c, d} {(a, b), (b, c), (c, c), (d, d), (d, a)}}. Draw the graph G & also draw undirected complete graph for K_G.   **(10)**

8. (a) Discuss about various type of trees with help of examples. Draw binary tree of 5 nodes with one leaf.   **(10)**

     (b) Explain tree traversing of binary tree using examples.   **(10)**

SECTION - E

9. Define & Explain following terms in brief:

     (a) Isomorphic Lattice   **(3)**

     (b) Cosets   **(3)**

     (c) Monoid   **(2)**

     (d) Total solution   **(2)**

     (e) Composition of functions   **(2)**

     (f) Shortest path   **(2)**

     (g) Universal quantifier   **(2)**

     (h) Rooted tree   **(2)**

     (i) Tautology.   **(2)**