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(Following Paper ID and Roll No. to be filled in your Answer Book)

Paper ID : 199358 Roll No. [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

B.Tech.

(SEM. III) THEORY EXAM. 2015-16

DISCRETE MATHEMATICS

[Time:3 hours] **[Total Marks:100]**

Section-A

1. Attempt all parts. All parts carry equal marks. Write answer of each part in short. **(2x10=20)**

   (a) Differentiate between Equal and Equivalent Sets with suitable example.

   (b) Give an example of a relation which is neither reflexive nor irreflexive.

   (c) Distinguish between Walk and Path.

   (d) Defferentiate between Ring and Field.

   (e) Define a distributive lattice.

   (f) Prove that divide relation on set of interger is partial order relation.

(g) How much reflexive, irreflexive, symmetric relation can be possibel on a set Having n number of sets?

(h) What are the different conditions for a function to be invertible ?

(i) Define the Identity law and Involution law of logic.

(j) Differentiate betweeen tautology and contradiction with suitabel example.

Section-B

Attempt **any five** questions from this section. **(10x5=50)**

2. Show that if $(L, \subseteq \cup, \cap)$ is a lattice, $(L, \supseteq \cup, \cap)$ is also a lattice. Also show that the Cartesian product of two lattice is a lattice.

3. Consider the following statement.

   "If flood destorys my house or the fire destorys my house, then my insurance company will pay me."

   Write the converse, inverse and contra positive of the above statement.

4. Consider the following recurrence relation.

   $T(n) = 7T(n/2) + 18n^2 \; n \geq 2$

   $T(1) = 1$ given that n is some power of 2 . Solve the given realtion.

5. Consider a set A = {1,2,3,4,5}

Define the relation '<' on A such that x<y if and only if (x mod 3) < (y mod 3)

(i) Prove that $(A, \leq)$ is POSET.

(ii) Draw the Hash diagram for $(a, \leq)$

(iii) What are the maximal elemeents?

(iv) What are minimal elements?

6. Let G be a group and let a, b $\in$ G be any elements. Then

(a) $(a^{-1})^{-1}=a$

(b) $(ab)^{-1}=b^{-1}a^{-1}$

7. Express the following Statement using Predicate and quantifier:

(a) For every student in this semester, that student has studied discrete mathematics.

(b) Some students in this semester have visited Allahabd .

(c) Every student in this semester visited either Agra or Allahabad.

8. Convet the following into CNF

(a) $\sim(P V Q) \leftrightarrow (P \wedge Q)$

(b) $P \wedge (P \rightarrow Q)$

9. (a) Show that $2^n < n!$ for $n \geq 4$

(b) Prove that $\sqrt{5}$ is not a rational number (prove by contradiction)

Section-C

Attempt **any two** questions from this section. (15x2=30)

10. Draw the Hasse-Diagram for the POSET and find Least upper bound and Greatest lower bound of each.

    (a) $(P(s), \subseteq$ where $P(s)$ is the power set on $S = \{a,b,c\}$

    (b) $(A, /)$ if $A = \{1,2,3,4,6,9,12,18,36\}$

    (c) $(A,/)$ if $A = (2,3,4,9,12,18)$

11. (a) Prove lagrange's theorem that states "for any finite group G the order of every group H divides the order of G".

    (b) Prove that intersection of two subgroup of a group is also a subgroup.

    (c) Show that $G = \{1,-1,i,i\}$, where $i^2 = -1$,is an abelian group with respect to multiplication as a binary operation.

12. (a) If R_1 and R_2 are equivalence relation in a Set A, show that $R_1 \cap R_2$ is also an equivalence relation.

    (b) Let N be the set of natural numbers and R be the relation on N X N define by (a,b) R (c,d) if ad =be $\forall$ a,b,c,d $\in$ N . show that R is an equivalence relation.

    (c) Explain planar graph, Bipartite Graph, Complete Graph, Wheel Graph.

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