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CSI-32

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ADIT/BIT PROGRAMME

Term-End Examination

December, 2010

CSI-32 : DISCRETE MATHEMATICS

Time : 3 hours *Maximum Marks : 75*

Note : *All questions from* ***Section - A*** *are* ***compulsory****. Attempt* ***any three*** *questions from* ***Section - B****.*

SECTION–A

1. State True/False for each of the following statements and also give reason for your answer : **10**

   (a) $P(S) \cap P(P(S)) = \{\phi\}$ for any set S, where P (S) denotes the power set of a given set S.

   (b) If R is symmetric and transitive then R is Reflexive and Hence R is an equivalence relation.

   (c) $\overline{(A \cap B)} = \overline{A} \cap \overline{B}$

   (d) $P(A \setminus B) = P(A) - P(A \cap B)$

   (e) If $f(x) = 3x - 7$ then $f^{-1}(x) = \frac{x-7}{3}$.

2. (a) Establish the equivalence 5

$P \rightarrow (Q \rightarrow R) \equiv (P \wedge Q) \rightarrow R$.

(b) Obtain the principal conjunctive normal form of $(p \wedge q) \vee (\sim p \wedge r)$. 5

3. (a) Express $P \leftrightarrow Q$ using $\uparrow$ and $\downarrow$ only. 4

(b) Prove that equality on any set is an equivalence relation. 3

(c) Let $f(x) = 2x + 1$ and $g(x) = 3x$. Find fog and gof ? 3

SECTION - B

*Attempt **any three** questions from this section.*

4. (a) Find all the partitions of $S = \{p, q, r, s\}$. 4

(b) A relation R is defined on the set I, the set of integers, by the rule : 'aRb if and only if $ab > 0$' for $a, b \in I$. Examine if R is reflexive, symmetric and transitive ? 6

(c) Draw Venn Diagram for $(A \cup B) \subseteq B$ and $B \subseteq A$. 5

5. (a) If R is a transitive relation on a set A, then show that R^{-1} is also transitive on A. 5

(b) Let $A = \{a, b\}$ 6

$R = \{(a, a), (b, a), (b, b)\}$ and

$S = \{(a, b), (b, a), (b, b)\}$ be relations on A. Then prove that $(SoR)^{-1} = R^{-1}oS^{-1}$.

(c) Show that the two functions $g, f : R \to R$ 4

such that

$f(x) = 2x + 7$ and

$g(x) = (x - 7)/2$

are inverses of each other.

6. (a) If the function $f: R \to R$ defined by $f(x) = x^2$, find $f^{-1}(4)$ and $f^{-1}(-4)$? 6

(b) Show that $(p \vee \sim q) \wedge (\sim p \vee \sim q) \vee q$ is tautology. 5

(c) Establish the logical equivalence 4

$\sim(p \to q) \equiv p \wedge \sim q$.

7. (a) Draw Hasse diagram of (d(12), divides). 5

(b) Prove that for any set A, B 6

$A - (A - B) = A \cap B$.

(c) Show that (6 5 4 3 1 2) is an even permutation while (6 7 5 1 2 3) is odd permutation. 4