Seat No. : _______________

NQ-121

November-2017

Second Year M.Sc., (CA&IT) (Integrated)

Discrete Maths

Time : 3 Hours] **[Max. Marks : 100**

1. Do the following : (Any **4**) **20**

   (1) Obtain PDNF of $\neg P \vee Q$ and Obtain PCNF of $(\neg P \rightarrow R) \wedge (Q \leftrightarrow P)$

   (2) Without constructing truth table show following implications :

   (a) $P \rightarrow Q \Rightarrow P \rightarrow (P \wedge Q)$

   (b) $(P \rightarrow Q) \rightarrow Q \Rightarrow P \vee Q$

   (3) By using Mathematical induction show that if n is a positive integer, then $1 + 2 + 3 + 4 \ldots + n = n(n+l)/2$

   (4) By using truth table show that $p \wedge (q \vee r)$ is equivalent to $(p \wedge q) \vee (p \wedge r)$

   (5) Define following :

   (a) Logical implications

   (b) Bi-Conditional Statement

   (c) PCNF

   (d) PDNF

   (e) Logical equivalence

2. Do the following : (Any **4**) **20**

   (1) Define the following :

   (a) POSET

   (b) Chain

   (c) LUB

   (d) Equivalence relation

   (e) Composite relation

   (2) Let X = {2, 3, 6, 12, 24, 36} and the relation <= be such that "x<=y if x divides y". Draw the Hasse diagram of (X, <=) and prove that (X, <=) is a POSET.

(3) Find the relation matrix M_R, ~ M_R(Converse of R), $M_{R^2} = M_R \circ M_R$ of a given relation R and also draw the graph of R.

R = {<a,b>, <a,c>, <b,a>, <c,a>, <c,b>, <b,c>} on the set {a,b,c}.

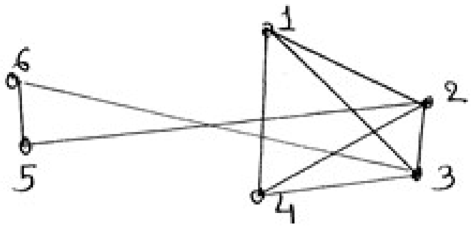
(4) Give examples of following :

(a) A relation which is both reflexive and symmetric.

(b) A relation which is neither reflexive nor irreflexive.

(c) A relation which is anti-symmetric.

(5) Define maximal compatible block of a relation. Find maximal compatible blocks of the relation given below.



3. Do the following : (Any **4**) **20**

(1) Define direct product of the lattices. Find direct product of the lattices S_4 and S_9. Draw the Hasse diagram of $S_4 \times S_9$

(2) Define Lattice. Let L = {A,B,C,D,E,F,G,H} where A={a,b,c,d,e,f}, B={a,b,c,d,e}, C={a,b,c,e,f}, D = {a,b,c,e}, E={a,b,c}, F={a,b}, G={a,c}, H={a}. Draw the diagram of (L, <=) and check whether it is lattice or not ?

(3) Define partition and covering. Check whether the following defined on the set X = {a, b, c} are partition or not ? Covering or not ?

(a) A={{a,b},{a,c}}

(b) B={{a},{a,c}}

(4) State and prove the Isotonicity property of Lattice.

(5) Define Sub-lattice and find all the sub-lattices of <S_{12}, D> where D means the relation "divides".

4. Do the following : (Any **4**) **20**

(1) Minimize the following Boolean function using K-Map :

F (a, b, c, d) = Σ(0,2,6,7,8,9,13,15)

(2) Simplify the following Boolean expression :

(a) (a*b)' + (a + b)'

(b) (a' * b' * c) + (a * b' * c) + (a * b' * c')

(3) Define Sub-Boolean algebra and find all sub-Boolean algebra of $<S_{66}, D>$ where D means the relation divides.

(4) Define Boolean algebra and show that in a Boolean algebra the following four statements are equivalent :

(a) a <=b

(b) a*b' =0

(c) a' + b=1

(d) b' <=a'

(5) Define Atoms and Anti-Atoms. Find Atoms and anti-atoms of (S_{45}, D) where D means the relation divides.

5. Do the following : (Any **2**) **20**

(1) Let G be a group. a and b are elements of G, then prove the following :

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

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

(2) Define normal subgroup and find all the normal subgroup of $<S_3, <>>$. Degree of S_3 is 3.

(3) Prove that every cyclic group is abelian. Is the converse true ?

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