RAN-1187

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B.Sc. Sem-VI Examination

March / April - 2019

MTH-605-Mathematics

(Discrete Mathematics)

(Old or New to be mentioned where necessary)

[Total Marks: 50

સૂચના : / Instructions

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fill up strictly the details of ☛ signs on your answer book

Name of the Examination:

☛ **B.Sc. Sem-VI**

Name of the Subject :

☛ **MTH-605-Mathematics**

Subject Code No.: **1 1 8 7**

Seat No.:

Student's Signature

(1) All questions are compulsory.
(2) Follow usual notations.
(3) Figures to the right indicate marks of the question.

Que:1 **Answer any FIVE as directed.** **[10]**

(1) State and prove absorption law with respect to meet and join operations.

(2) Define : Lattice Homomorphism.

(3) State modular inequality in a lattice.

(4) Write the Boolean expression $(x_1 * x_2)$ in the sum of the products canonical form in the variables x_1 x_2 and x_3.

(5) Define sub lattice with one illustration.

(6) Show that 1 is the only complement of 0.

(7) In Boolean algebra, prove that $a \oplus (a' * b) = a \oplus b$

(8) In a Boolean Algebra, prove that
$a \leq b \Rightarrow a + b \,.\, c = b \,.\, (a + c)$.

Que:2 **Answer the following (any TWO).** **[10]**

(1) Define a partially ordered relation. Prove that $\langle p(A), \subseteq \rangle$ is a partially ordered set. Where $\rho(A)$ is a power set of A and define the relation $\subseteq$ (inclusion).

(2) Let $X = \{1, 2, 3, 4, 6, 8, 12, 24, 48\}$ and the relation " $\leq$ " be the divides. Draw the Hasse diagram of $< X, \leq >$. Is it a sub lattice of $< l_+, D >$? Justify.

(3) Let R denote a relation on the set of ordered pairs of positive integers such that $\langle x\ y \rangle\ R\ \langle u, v \rangle$ if and only if $xv = yu$. Show that R is an equivalence relation.

Que:3 **Answer the following (any TWO).** **[10]**

(1) Let $(L, \leq)$ be a lattice. For any $a, b, c \in$ L, prove that

(a) $a \oplus (b * c) \leq (a \oplus b) * (a \oplus c)$

(b) $a * (b \oplus c) \geq (a * b) \oplus (a * c)$

(2) Let $< B, *, \oplus, ', 0, 1 >$ is a Boolean algebra. Let S be a non empty subset of B. If S preserving the operations $\oplus$ and ' then prove that $< S, *, \oplus, ', 0, 1 >$ is a sub-boolean algebra.

(3) Let $(L, \leq)$ be a lattice. For any $a, b, c \in L$, prove that $a \leq b \Leftrightarrow a * b = a \Leftrightarrow a \oplus b = b$

Que:4 **Answer the following (any TWO).** **[10]**

(1) Obtain the sum of products canonical form of the Boolean expression $x_1 \oplus (x_2 * x_3')$.

(2) Simplify the following Boolean expressions:

(a) $(a * b)' \oplus (a \oplus b)'$

(b) $(a' * b' * c) \oplus (a * b' * c) \oplus (a * b' * c')$

(3) Let $\langle B, *, \oplus, ', 0, 1 \rangle$ be a Boolean Algebra. Define the operations ' + ' and ' $\cdot$ ' on the elements of B by $a + b = (a * b') \oplus (a' * b)$ and $a \cdot b = a * b$; then prove that

(a) $a + a = 0$

(b) $(a + b) \oplus a \cdot b = a * b$

(c) $a \cdot (b + c) = (a \cdot b) + (a \cdot c)$

Que:5 Answer the following (any TWO). [10]

(1) Use Karnaugh map representation to find the minimal sum of products of the function $f(a, b, c, d) = \Sigma\,(5,7,10,13,15)$

(2) Use Quine McCluskey algorithm to find the minimal sum of products form of $f(a, b, c, d) = \Sigma(10,12,13,14,15)$.

(3) Find the minimal sum of products of the function $f(a, b, c, d) = \Sigma(0,2,6,7,8,9,13,15)$ by using Karnaugh map representation.