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# RAN-0954

## S.Y.B.Sc. Sem - IV Examination

## March / April - 2019

## Mathematics Paper: MCS - 402

## Discrete Mathematics - II

**Time: 2 Hours ]** **[ 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:

☛ **S.Y.B.Sc. Sem - IV**

Name of the Subject :

☛ **Mathematics Paper: MCS - 402**

Subject Code No.: 0 9 5 4

Seat No.:

Student's Signature

**Instruction:**

(1) Figures to the right indicate marks of corresponding question.
(2) Follow usual notations.
(3) Use of non-programmable scientific calculator is allowed.

**Q-l]** **Answer the following:** **[10]**

1] Determine which of the following congruence are true or false?

(i) $6 \equiv -8 \pmod 4$ (ii) $3 \equiv 3 \pmod 7$

2] Show that $2^6 - 1$ is divisible by 7 using Fermat's little theorem.

3] Define chain with illustration.

4] Define direct product of two lattices.

5] Define Boolean homomorphism.

**Q-2]** **Answer (any two) of the following:** **[10]**

1] Let $ax \equiv b \pmod m$ where $\gcd(a; m) = d$, then show that if d does not divide b, then the congruence has no solution.

2] Determine whether the ISBNs are valid or not:

(i) 81-85015-70-6 (ii) 0-07-101202-2

3] Show that for all n in N, $3^{3n+1} \equiv 3.5^n \pmod{11}$. Obtain a corresponding result about $2^{4n+3}$ and deduce that, $11 \mid (3^{3n+1} + 2^{4n+3})$

4] Solve: $18x = 30 \pmod{42}$

**Q-3] Answer (any two) of the following: [10]**

1] In a complemented lattice prove $a \leq b \Longleftrightarrow a * b' = 0 \Longleftrightarrow a' \oplus b = 1 \Longleftrightarrow b' \leq a'$

2] Which of the two lattices $<S_n, D>$ for n = 30 and n = 45 are complemented? Are these lattices distributive?

3] Show that De' Morgan's laws hold in a complemented distributive lattice.

4] Show that in $<L, \leq>$ if $a \leq b$ and $c \leq d$ then

(i) $a * c \leq b * d$ (ii) $(a * b) \oplus (c * d) \leq (a \oplus c) * (b \oplus d)$

**Q-4] Answer (any two) of the following: [10]**

1] If a mapping f: B →P preserves the operation * and ' then prove that it is a Boolean Homomorphism.

2] Find the value of the Boolean expression $f(x_1, x_2, x_3) = \sum 0, 3, 5, 7$.

Find f (a, b, 1) and $(x_1 * x_2) * [(x_1 * x_4) \oplus x'_2 \oplus (x_3 * x'_1)]$.

Find $\alpha$ $(x_1\ x_2; x_3, x_4) = a\ (a, 1, b, 1)$.

3] Show that a chain of 3 or more elements is not complemented.

4] Let $< B,*,\oplus, , ', 0,1 >$ be a Boolean algebra and $S \subseteq B$.
If S is closed w. r. t. 'and ⊕ then, prove that $< S,*,\oplus,', 0,1 >$ is a sub boolean algebra.

**Q-5] Answer (any two) of the following: [10]**

1] Find the product of sum cannonical form of $(x_1 \oplus x_2)' * x_3$.

2] Use K-map representation to find a minimal sum of product canonical form of the function f(a, b, c, d) = a' b'; c' d' + a b' c' d' + a' b' c d' + a b' c d'

3] Express the Boolean function f (a, b, c) = a b + a' c as a product of maxterms.

4] Obtain minimal function by Karnaugh map representation of f (a, b, c, d) = ∑ (0, 1, 2, 3, 13, 15)