

(4)

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5. (a) Prove that if  $m + n \geq 73$ , then  $m \geq 37$  or  $n \geq 37$ ,  $m$  and  $n$  being positive integers.

(CO3)

OR

- (b) Prove that  $\sqrt{2}$  is irrational by giving a proof by contradiction. (CO3)

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TMC-104

M. C. A. (FIRST SEMESTER)

MID SEMESTER

EXAMINATION, 2021-22

DISCRETE STRUCTURE AND

COMBINATORICS

Time : 1 : 30 Hours

Maximum Marks : 50

Note : (i) Answer all the questions by choosing any *one* of the sub-questions.

(ii) Each question carries 10 marks.

1. (a) Consider the following relation on  $\{1, 2, 3, 4, 5, 6\}$ :

$$R = \{(i, j) : |i - j| = 2\}$$

Check for the symmetricity, reflexivity and transitivity of  $R$ . (CO4)

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OR

(b) Suppose  $R$  and  $S$  are relations on a set  $A$ .

Prove that if  $R$  and  $S$  are reflexive, then

$R \cap S$  and  $R \cup S$  are reflexive. (CO4)

2. (a) Let  $A = \{a, b, c, d\}$  and  $R$  be a relation

defined on  $A$  whose matrix representation is :

$$M_R = \begin{vmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{vmatrix}$$

Examine the reflexive and symmetric properties of  $R$ . (CO4)

OR

(b) Let  $f, g : \mathbb{R} \rightarrow \mathbb{R}$  be two functions such

that  $f(x) = 2x + 1$  and  $g(x) = \frac{x}{3}$ .

Verify  $(g \circ f)^{-1} = f^{-1} \circ g^{-1}$ . (CO4)

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3. (a) Draw the Hasse diagram for the poset

$(\{1, 2, 3, 4, 5, 6\}, \mid)$ . Let  $B = \{2, 3\}$ ,

$C = \{4, 6\}$ ,  $D = \{3, 6\}$ . Find LUB and

GLB for all the given subsets. (CO3)

OR

(b) Construct the truth table for : (CO4)

(i)  $p \vee \sim q \Rightarrow p$

(ii)  $(\neg(p \wedge q) \vee r) \rightarrow \sim p$

4. (a) By using algebra of propositions, show that  $p \Rightarrow q \equiv (p \vee q) \Rightarrow (p \wedge q)$ . (CO1)

OR

(b) By using principle of mathematical induction, show that : (CO1)

$$3 + 33 + 333 + \dots + 33\dots3$$

$$= \frac{10^{n+1} - 9n - 10}{27}$$