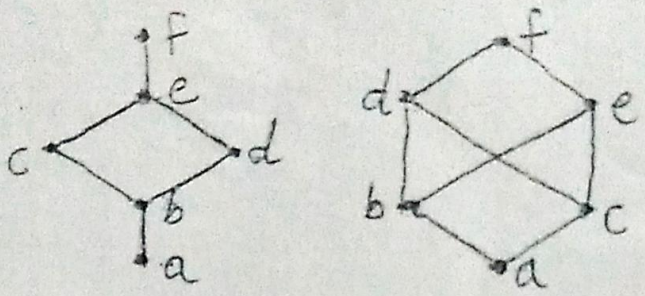
Name:
Student University Roll No.: Printed Pages: 2

School of Engineering
Second Sessional Examination, Odd Semester (AS: 2023-24)
B. Tech: CSE/CSAI/CCML/IOTBC Year: II Semester: III
Course Title: Discrete Mathematics
Course Code: BCS3301
Max Marks: 60
Time: 3*hrs*

Instructions if any: Read the question Carefully.

	SECTION 'A' Q.N.1. Attempt all parts of the following:	Course Objective	Marks
a)	For set A and B prove that $(A \cap B) \cup (A \cap \sim B) = A$	CO1	1
b)	If $f(x) = 3x+1$ and $g(x) = x^2$, then determine $gof(x)$	CO1	1
c)	Define Modular Lattice.	CO2	1
d)	Define Cosets.	CO2	1
e)	Use **quantifier** to Convert the following statement in quantified expressions of predicate logic *"All rational numbers are real numbers."*	CO3	1
f)	Define Complemented Lattice.	CO2	1
g)	Define Hamiltonian Path	CO4	1
h)	Define Binary Search Tree	CO4	1
	SECTION 'B' Q.N.2. Attempt any two parts of the following:	**Course Objective**	**Marks**
a)	For each of these relations defined on the set {1, 2, 3, 4}, decide whether it is reflexive, whether it is symmetric, whether it is anti-symmetric, and whether it is transitive. (i) {(2, 2), (2, 3), (2, 4), (3, 2), (3, 3), (3, 4)} (ii) {(1, 1), (2, 2), (3, 3), (4, 4)} (iii) {(1, 3), (1, 4), (2, 3), (2, 4), (3, 1), (3, 4)}	CO1	6
b)	Solve the recurrence relation: $a_r - 3a_{r-1} + 2a_{r-2} = 0$, $r \geq 2$ by the generating function method with $a_0 = 2$ and $a_1 = 3$.	CO4	6
c)	Determine whether the POSETs represented by each of the following Hasse Diagrams are	CO2	6

	lattices.  		
d)	(i) Suppose that C = "The cheese is good." F = "The french fries are greasy." W = "The wings are spicy." Translate the following logical statements into words $(\neg C \wedge F) \rightarrow W$ (ii) Draw a **Truth table** for the following compound statement $(\neg PVQ) \leftrightarrow (Q \rightarrow R)$	CO3	6
	SECTION 'C'	**Course Objective**	**Marks**
Q.N.3. Attempt any two parts of the following:			
a)	For any three non empty set A, B, and C prove that $A \times (B - C) = A \times B - A \times C$	CO1	5
b)	Show that the mapping defined by $f: R-\{3\} \rightarrow R-\{1\}$ such that $f(x) = (x-1)/(x-3)$ is bijective and find the inverse of this function, where R is a set of real numbers.	CO1	5
c)	Use mathematical induction to prove that $6^{n+2}+7^{2n+1}$ **is divisible by 43 for** $n \geq 1$	CO1	5
Q.N.4. Attempt any two parts of the following:			
a)	Prove that set R = {0, 1, 2, 3, 4, 5} is a commutative ring with respect to addition module 6 ($+_6$) and multiplication module 6 (X_6).	CO2	5
b)	Draw a Hasse Diagram of $(P(A), \subseteq)$ where A = {a, b, c}. Then prove that it is a Lattice.	CO2	5
c)	Let **G = {1,-1,i,-i}** with the operation of ordinary multiplication on G be an algebraic structure, where $i=\sqrt{-1}$.	CO2	5

	(i) Determine whether G is abelian or not. (ii) Determine the order of each element in G. (iii) Determine whether G is a cyclic group, if G is a cyclic group, then determine the generator/generators of the group G.		
Q.N.5. Attempt any two parts of the following:			
a)	Simplify following Boolean function using K map $F(A,B,C,D) = \sum(m_0, m_1, m_2, m_4, m_5, m_6, m_8, m_9, m_{12}, m_{13}, m_{14})$	CO3	5
b)	Use rules of inference to show that the hypotheses "Randy works hard," "If Randy works hard, then he is a dull boy," and "If Randy is a dull boy, then he will not get the job" imply the **conclusion**: "Randy will not get the job."	CO3	5
c)	Write the contra-positive, converse and inverse of the following statements: (i) If today is Sunday, then I will wash the car. (ii) If $x+5=8$ then $x=3$	CO3	5
Q.N.6. Attempt any two parts of the following:			
a)	Write short notes on following: i) Multi Graphs ii) Planar Graphs iii) Euler Graph iv) Pigeon hole principle. v) Chromatic Number	CO4	5
b)	Solve following recurrence relation. $a_r + 6a_{r-1} + 9a_{r-2} = 3$ given that $a_0 = 0$ and $a_1 = 1$	CO4	5
c)	How many vertices do the graph will have if it contains, 3 vertices of degree 2, 4 vertices of degree 3, rest vertices have degree 4. Number of edges in a graph is 15.	CO4	5

Table 1: Mapping between COs and questions
(Number of COs may vary from course to course)

COs	Questions Numbers	Total Marks
CO1	Q1.(a).(b). Q2.(a). Q3	23
CO2	Q1.(c)..(d) .Q2(c). Q4	23
CO3	Q1.(e)(f) Q2.(d). Q5	23
CO4	Q1.(g)(h).Q2(b). Q6	23