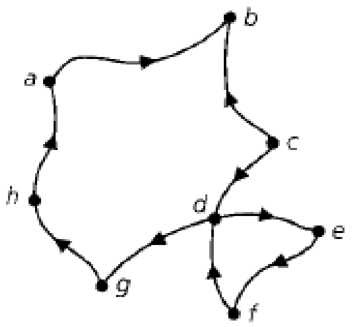
	ITER, SIKSHA 'O' ANUSANDHAN (Deemed to be University)		**ASSIGN-MENT**
Branch	**CSE & CSIT**	Programme	**B.Tech**
Course Name	**Intermediate Discrete Mathematics**	Semester	**V**
Course Code	**CSE 2733**	Year/Period	**2023/Odd**
	Submit All Assignments	Maximum Marks	**10**

Learning Level (LL)			
	L1: Remembering	**L3:** Applying	**L5**: Evaluating
	L2: Understanding	**L4**: Analysing	**L6**: Creating

No.	**Assignment-2**	COs	LL
Q.1	**a)** Rephrase the definitions for the reflexive, symmetric, transitive, and antisymmetric properties of a relation $\mathfrak{R}$ (on a set A), using quantifiers. **b)** Use the results of part (a) to specify when a relation $\mathfrak{R}$ (on a set A) is (i) *not* reflexive; (ii) *not* symmetric; (iii) *not* transitive; and (iv) *not* antisymmetric.	**CO2**	**L2**
Q.2	For each of the following statements about relations on a set A, where $\lvert A\rvert = n$, determine whether the statement is true or false. If it is false, give a counterexample. **a)** If $\mathfrak{R}$ is a relation on A and $\lvert\mathfrak{R}\rvert \geq n$, then $\mathfrak{R}$ is reflexive. **b)** If $\mathfrak{R}_1$, $\mathfrak{R}_2$ are relations on A and $\mathfrak{R}_2 \supseteq \mathfrak{R}_1$, then $\mathfrak{R}_1$ reflexive (symmetric, antisymmetric, transitive) $\Rightarrow \mathfrak{R}_2$ reflexive (symmetric, antisymmetric, transitive). **c)** If $\mathfrak{R}_1$, $\mathfrak{R}_2$ are relations on A and $\mathfrak{R}_2 \supseteq \mathfrak{R}_1$, then $\mathfrak{R}_2$ reflexive (symmetric, antisymmetric, transitive) $\Rightarrow \mathfrak{R}_1$ reflexive (symmetric, antisymmetric, transitive). **d)** If $\mathfrak{R}$ is an equivalence relation on A, then $n \leq \lvert\mathfrak{R}\rvert \leq n^2$.	**CO2**	**L3**
Q.3	If $A = \{w, x, y, z\}$, determine the number of relations on A that are (a) reflexive; (b) symmetric; (c) reflexive and symmetric; (d) reflexive and contain (x, y); (e) symmetric and contain (x, y); (f) antisymmetric; (g) antisymmetric and contain (x, y); (h) symmetric and antisymmetric; and (i) reflexive, symmetric, and antisymmetric.	**CO2**	**L2**
Q.4	Let A be a set with $\lvert A\rvert = n$, and let $\mathfrak{R}$ be a relation on A that is antisymmetric. What is the maximum value for $\lvert\mathfrak{R}\rvert$? How many antisymmetric relations can have this size?	**CO2**	**L2**

Q.5	With $A = \{1, 2, 3, 4\}$, let $\mathcal{R} = \{(1, 1), (1, 2), (2, 3), (3, 3), (3, 4), (4, 4)\}$ be a relation on A. Find two relations $\mathcal{S}$, $\mathcal{T}$ on A where $\mathcal{S} \neq \mathcal{T}$ but $\mathcal{R} \circ \mathcal{S} = \mathcal{R} \circ \mathcal{T} = \{(1, 1), (1, 2), (1, 4)\}$.	**CO2**	**L2**
Q.6	Let A be a set with $\lvert A \rvert = n$, and let $\mathcal{R}$ be an equivalence relation on A with $\lvert \mathcal{R} \rvert = r$. Why is $r - n$ always even?	**CO2**	**L2**
Q.7	Determine how many integer solutions there are to $x_1 + x_2 + x_3 + x_4 = 19$, if **a)** $0 \leq x_i$ for all $1 \leq i \leq 4$ **b)** $0 \leq x_i < 8$ for all $1 \leq i \leq 4$ **c)** $0 \leq x_1 \leq 5$, $0 \leq x_2 \leq 6$, $3 \leq x_3 \leq 7$, $3 \leq x_4 \leq 8$	**CO2**	**L2**
Q.8	For the directed graph $G = (V, E)$ in Fig. 7.12, classify each of the following statements as true or false. **a)** Vertex c is the origin of two edges in G. **b)** Vertex g is adjacent to vertex h. **c)** There is a directed path in G from d to b. **d)** There are two directed cycles in G. 	**CO2**	**L2**
Q.9	**a)** Draw the digraph $G_1 = (V_1, E_1)$ where $V_1 = \{a, b, c, d, e, f\}$ and $E_1 = \{(a, b), (a, d), (b, c), (b, e), (d, b), (d, e), (e, c), (e, f), (f, d)\}$. **b)** Draw the undirected graph $G_2 = (V_2, E_2)$ where $V_2 = \{s, t, u, v, w, x, y, z\}$ and $E_2 = \{\{s, t\}, \{s, u\}, \{s, x\}, \{t, u\}, \{t, w\}, \{u, w\}, \{u, x\}, \{v, w\}, \{v, x\}, \{v, y\}, \{w, z\}, \{x, y\}\}$.	**CO2**	**L2**

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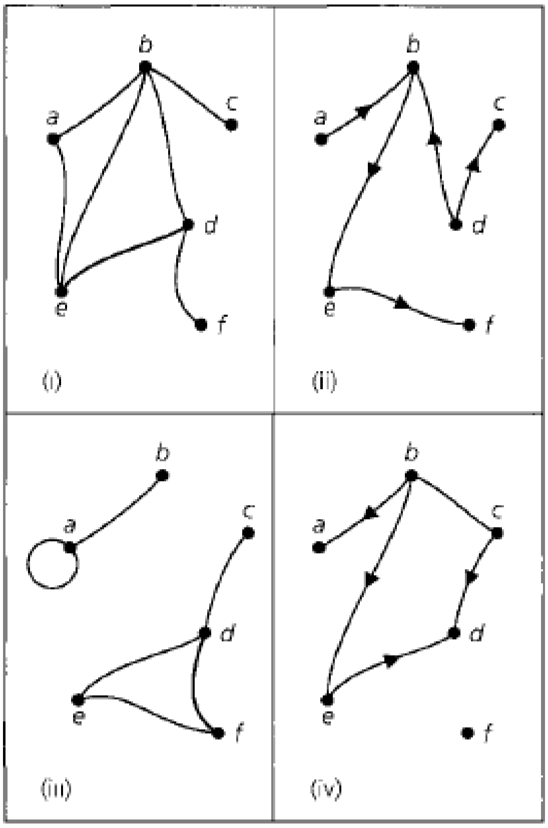
<td>Q.10</td>
<td>For $A = \{a, b, c, d, e, f\}$, each graph, or digraph, in Fig. 7.13 represents a relation $\mathcal{R}$ on A. Determine the rela-


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<td>CO3</td>
<td>L2</td>
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Note:

1. Marks distribution will be as per course instructor.
2. Assignments need to be submitted before due date.
3. The Assignments/Quiz in total carry weightage of **20 marks out of 100**

Course Outcomes		**Program Outcomes**
CO1	Able to understand the concept of languages and finite state machines as well as its various applications.	PO1, PO2,
CO2	Able to apply relations and its properties to analyze equivalence relations and partial orderings.	PO1, PO2
CO3	Able to understand the concepts of generating functions and recurrence relations as well as apply generating functions to solve recurrence relations.	PO1, PO2
CO4	Able to understand and analyze the concepts of rings and modular arithmetic.	PO2,
CO5	Able to understand and apply the concepts of Boolean algebra and switching functions.	PO2
CO6	Able to understand and analyze the concepts of groups, coding theory and finite fields.	PO2