PARUL UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
Department of Applied Sciences & Humanities
Third Semester B. Tech (CSE, IT) (2025-26)
Discrete Mathematics (303191202)
Tutorial 1 - Sets, Relations and Functions

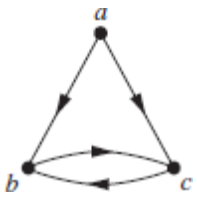
Q.1. List the ordered pairs in the relation R from $A = \{0, 1, 2, 3, 4\}$ to $B = \{0, 1, 2, 3\}$, where $(a, b) \in R$ if and only if **(a)** $\gcd(a, b) = 1$ **(b)** $\text{lcm}(a, b) = 2$.

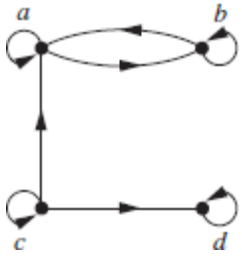
Q.2. Determine whether the relation R on the set of all real numbers is reflexive, symmetric, antisymmetric, and/or transitive, where $(x, y) \in R$ if and only if
(a) $x + y = 0$. **(b)** $x - y$ is a rational number.

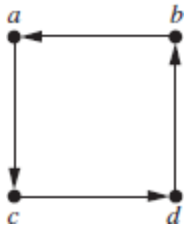
Q.3. Consider these relations on the set of integers:
$R_1 = \{(a, b) \mid a \leq b\}$,
$R_2 = \{(a, b) \mid a > b\}$,
$R_3 = \{(a, b) \mid a = b \text{ or } a = -b\}$,
$R_4 = \{(a, b) \mid a = b\}$,
$R_5 = \{(a, b) \mid a = b + 1\}$,
$R_6 = \{(a, b) \mid a + b \leq 3\}$.
Which of these relations are reflexive, symmetric, antisymmetric and transitive or not? Justify your answers.

Q.4. Let R and S be relations on a set A represented by the matrices $M_R = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ and $M_S = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$. Find the matrices representing the following relations.
(a) $R \cup S$ (b) $R \cap S$ (c) $S \circ R$ (d) $R \circ S$ (e) $R \oplus S$

Q.5. Write the relation represented by the following digraph and also write the matrix representing this relation.

(a) 

(b) 

(c) 

Q.6. Write the relation represented by the following matrices and also draw the corresponding digraph.

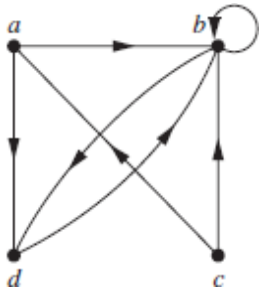
(a) $\begin{bmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$ **(b)** $\begin{bmatrix} 0 & 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 & 0 \end{bmatrix}$ **(c)** $\begin{bmatrix} \mathbf{1} & \mathbf{0} & \mathbf{0} & \mathbf{1} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{1} & \mathbf{0} & \mathbf{0} & \mathbf{1} \end{bmatrix}$

Q.7. Check if the relations given by the following are reflexive, symmetric, antisymmetric, and/or transitive:

(a) $R = \{(x, y) | x = 2y\}$

(b) $M_R = \begin{bmatrix} \mathbf{1} & \mathbf{0} & \mathbf{0} & \mathbf{1} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{1} & \mathbf{0} & \mathbf{0} & \mathbf{1} \end{bmatrix}$

(c)



Q.8. Consider the following database.

Flights.

Airline	*Flight_number*	*Gate*	*Destination*	*Departure_time*
Nadir	122	34	Detroit	08:10
Acme	221	22	Denver	08:17
Acme	122	33	Anchorage	08:22
Acme	323	34	Honolulu	08:30
Nadir	199	13	Detroit	08:47
Acme	222	22	Denver	09:10
Nadir	322	34	Detroit	09:44

a) What will be the result when one applies the selection operator S_C, where C is the condition $Destination = Detroit$ to the database?
b) Display the table produced by applying the projection $P_{1,2,4}$.
c) Display the table produced by applying the projection $P_{1,4}$.

Q-9 If A= {3, 4, 5} and R is defined as aRb iff $a + b > 10$, then R is a ____relation**. [Summer 2017 – 18]**

Q-10 Suppose that $A = \{1, 2, 3\}$ and $B = \{1, 2\}$. Let R be the relation from A to B containing (a, b) if $a \in A$, $b \in B$, a > b. What is the matrix representing R? **[Winter 2019 – 20]**

Q-11 If A = {1,2,3,4,5,6} and R = {(x, y)/ |x − y| = 3, x ∈ A, y ∈ A}. Then, the relation set *R* on A = _____.

A) {(3,1), (4,2), (5,3), (6,4)}
B) {(1,4), (2,5), (3,6)}
C) {(1,3), (3,1), (2,4), (4,2), (3,5), (5,3), (4,6), (6,4)}
D) {(1,4), (2,5), (3,6), (4,1), (5,2), (6,3)}

[Winter 2023 – 24]

Q-12 Given $S = \{1, 2, 3, \ldots\ldots, 10\}$ and a relation R on S. Where $R = \{(x, y) \mid x + y = 10\}$, decide whether it is reflexive, whether it is symmetric, whether it is antisymmetric, and whether it is transitive. (Justify your answer if the property is not satisfied). **[Winter 2023 – 24]**

Q-13 Define closure property of reflexive**. [Winter 2022-23]**

Q-14 Draw the Hasse diagram for the poset (A,≤) With A = {1, 2, 3, 9, 18} and ≤ as the 'divides relation'

Q-15 Which of the partially order sets in the following figures are lattices? Justify your answers with appropriate reasons.

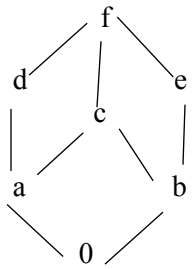


Figure-1

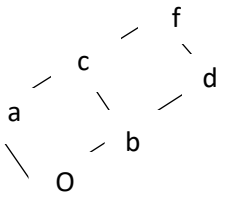


Figure-2