

Q₁] Let $R = \{(x, y) / |x - y| \leq 1\}$ and
 $S = \{(x, y) / 2x + y \leq 6\}$ be 2 relations
defined on the set $A = \{1, 2, 3, 4\}$.

(a) List the elements of R and S .

(b) Find the matrices of M_R , M_S and $M_{R \circ S}$

Q₂] Let T be a relation defined on $A = \{1, 2, 3, 5, 6, 15\}$
by $x T y \Leftrightarrow \frac{x}{y}$ is odd

(i) List the elements of T .

(ii) Show that (A, T) is a poset.

(iii) Is T a totally relation on A ?
Justify your answer.

(iv) Draw the Hasse diagram.

Q₁

(a) $R = \{ (1,1); (1,2); (2,2); (2,1); (2,3); (3,2); (3,3); (3,4); (4,3); (4,4) \}$
 $S = \{ (1,1); (1,2); (1,3); (1,4); (2,1); (2,2) \}$

(b) $M_R = \begin{pmatrix} 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 \end{pmatrix}; M_S = \begin{pmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$

$$M_{R \circ S} = M_S \circ M_R = \begin{pmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix} \circ \begin{pmatrix} 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 \end{pmatrix}$$

$$M_{R \circ S} = \begin{pmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$

Q₂

(i) $T = \{ (1,1); (2,2); (3,3); (5,5); (6,6); (15,15); (3,1); (5,1); (15,1); (6,2); (15,3); (15,5) \}$

- (ii) T is reflexive on A because $I_A \subset T$
 T is antisymmetric because if $(a,b) \in T$
 then $(b,a) \notin T$
 T is transitive because $T \circ T \subset T$

So (A, T) is a poset.

- (iii) T is not totally because $3 \not\sim 6$ and $6 \not\sim 3$
 $3 \leq 6$ are not comparable.

