L10 09 Feb 2022

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\# Let A be the set $\{1,2,3,4\}$ which ordered pair are in the relation

$R = \{(a,b) \mid a \text{ divides } b\}$

\# $R = \{(1,1)\ (1,2), (1,3), (1,4)\ (2,4), (2,2)\ (3,3)\ (4,4)\}$

Types of Relations :→

1) Reflexive Relation :→

A relation R on a set A is called reflexive if $(a,a) \in R$ for every $a \in A$.

Consider the following relations on $\{1, 2, 3, 4\}$:

$R_1 = \{(1, 1), (1, 2), (2, 1), (2, 2), (3, 4), (4, 1), (4, 4)\}$,

$1R1$, $2R2$, $3R3$, $4R4$

$(3,3) \notin R_1 \Rightarrow R_1$ is not reflexive

$R_2 = \{(1, 1), (1, 2), (2, 1)\}$, is not Reflexive

$R_3 = \{(1, 1), (1, 2), (1, 4), (2, 1), (2, 2), (3, 3), (4, 1), (4, 4)\}$, is Reflexive.

$R_4 = \{(2, 1), (3, 1), (3, 2), (4, 1), (4, 2), (4, 3)\}$, is not Reflexive

$R_5 = \{(1, 1), (1, 2), (1, 3), (1, 4), (2, 2), (2, 3), (2, 4), (3, 3), (3, 4), (4, 4)\}$, is Reflexive

$R_6 = \{(3, 4)\}$. is not Reflexive

Which of these relations are reflexive?

$\ldots -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, \ldots$

Consider these relations on the set of integers:

$R_1 = \{(a, b) \mid a \le b\}$, Reflexive

$R_2 = \{(a, b) \mid a > b\}$, Not Reflexive

$R_3 = \{(a, b) \mid a = b \text{ or } a = -b\}$, Reflexive

$R_4 = \{(a, b) \mid a = b\}$, Reflexive

$R_5 = \{(a, b) \mid a = b + 1\}$, Not Reflexive

$R_6 = \{(a, b) \mid a + b \le 3\}$. Not Reflexive

$R_1 = \{(a,b) \mid a \le b\}$

$R_3 = \{(a,b) \mid a = b \text{ or } a = -b$

$(1,1) \in R_3 \Rightarrow 1 = 1$

② Symmetric Relation :→

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A relation R on a set A is called symmetric if $(b,a) \in R$ whenever $(a,b) \in R$. for all $a,b \in A$.

$(a,b) \in R$ but $(b,a) \notin R$ → not symmetric

Consider the following relations on {1, 2, 3, 4}:

$R_1 = \{(1, 1), (1, 2), (2, 1), (2, 2), (3, 4), (4, 1), (4, 4)\}$, → Not symmetric $\because (4,3) \notin R_1$

$R_2 = \{(1, 1), (1, 2), (2, 1)\}$, → symmetric

$R_3 = \{(1, 1), (1, 2), (1, 4), (2, 1), (2, 2), (3, 3), (4, 1), (4, 4)\}$, → Symmetric

$R_4 = \{(2, 1), (3, 1), (3, 2), (4, 1), (4, 2), (4, 3)\}$, → Not Symmetric $\because (1,2) \notin R_4$

$R_5 = \{(1, 1), (1, 2), (1, 3), (1, 4), (2, 2), (2, 3), (2, 4), (3, 3), (3, 4), (4, 4)\}$, → not symmetric $(2,1) \notin R_5$

$R_6 = \{(3, 4)\}$. → not symmetric $\because (4,3) \notin R_6$

③ Antisymmetric

A Relation R on a set A such that for all $a,b \in A$ if $(a,b) \in R$ and $(b,a) \in R$ then $a=b$ is called antisymmetric.

$a \neq b$
$(a,b) \in R$ then $(b,a) \notin R$

$(a,b) \in R$ then $(b,a) \notin R$

$a=b$

Consider the following relations on {1, 2, 3, 4}:

$R_1 = \{(1, 1), (1, 2), (2, 1), (2, 2), (3, 4), (4, 1), (4, 4)\}$, not antisymmetric

$R_2 = \{(1, 1), (1, 2), (2, 1)\}$, → not antisymmetric

$R_3 = \{(1, 1), (1, 2), (1, 4), (2, 1), (2, 2), (3, 3), (4, 1), (4, 4)\}$, not antisymmetric

$R_4 = \{(2, 1), (3, 1), (3, 2), (4, 1), (4, 2), (4, 3)\}$, Antisymmetric

$R_5 = \{(1, 1), (1, 2), (1, 3), (1, 4), (2, 2), (2, 3), (2, 4), (3, 3), (3, 4), (4, 4)\}$, → antisymmetric

$R_6 = \{(3, 4)\}$. antisymmetric

$R_7 = \{(1,1)\ (1,2)\ (2,2)\ (3,4)\ (4,1)\ (4,4)\}$

Antisymmetric