T7 G2 10 Feb 2022

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④ Transitive Relation :→

A Relation R on a set A is called transitive if whenever $(a,b) \in R$ and $(b,c) \in R$ then $(a,c) \in R$ for all $a,b,c \in A$.

aRb, bRc

aRc

aRb and bRc $\rightarrow$ aRc

(1,1) (3,1)

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 Transitive ∵ $(3,1) \notin R_1$

$R_2 = \{(1,1), (1,2), (2,1)\}$, Not Transitive ∵ $(2,1)\ (1,2) \in R_2$ but $(2,2) \notin R_2$

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

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

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

$R_6 = \{(3,4)\}$. → Transitive

R_3

$(1,1)\ (1,2) \rightarrow (1,2)$

$(1,1)\ (1,4) \rightarrow (1,4)$

$(1,2)\ (2,1) \rightarrow (1,1)$

$(1,2)\ (2,2) \rightarrow (1,2)$

$(1,4)\ (4,1) \rightarrow (1,1)$

$(1,4)\ (4,4) \rightarrow (1,4)$

$(2,1)\ (1,1) \rightarrow (2,1)$

$(2,1)\ (1,2) \rightarrow (2,2)$

$(2,1)\ (1,4) \rightarrow (2,4)$

R_3 is not transitive

$R_4 = \{(2,1), (3,1), (3,2), (4,1), (4,2), (4,3)\}$, → Transitive Relation

(2,1) (3,1)

$(3,2)\ (2,1) \rightarrow (2,1)$

(4,1)

$(4,2)\ (2,1) \rightarrow (4,1)$

$(4,3)\ (3,1) \rightarrow (4,1)$

$(4,3)\ (3,2) \rightarrow (4,2)$

\# Determine whether the relation R on the set of all people is reflexive, symmetric, antisymmetric, and/or transitive, where $(a, b) \in R$ if and only if

a) a is taller than b.

b) a and b were born on the same day.

c) a has the same first name as b.

d) a and b have a common grandparent.

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

Reflexive, Symmetric, not antisymmetric, Transitive

Reflexive, Symmetric not antisymmetric, Transitive

Reflexive, Symmetric not antisymmetric Transitive

(a) $R = \{(a,b) \mid a \text{ is taller than } b\}$

antisymmetric

i) Not Reflexive ∵ a is not taller than a

$(a,a) \notin R$.

(ii) not Symmetric ∵ $(a,b) \in R$ then $(b,a) \notin R$

(iii) Transitive a is taller than b, b is taller than c

$\Rightarrow$ a is taller than c

$(a,c) \in R$

How many reflexive relations are there on a set with 3 elements?