Show All Solutions

Rosen, Discrete Mathematics and Its Applications, 8th edition
Extra Examples
Section 9.1—Relations and Their Properties

Extra Examples — *Page references correspond to locations of Extra Examples icons in the textbook.*

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p.604, icon at Example 10
#1. Let R be the following relation defined on the set $\{a, b, c, d\}$:

$$R = \{(a, a), (a, c), (a, d), (b, a), (b, b), (b, c), (b, d), (c, b), (c, c), (d, b), (d, d)\}.$$

Determine whether R is:

(a) reflexive. (b) symmetric. (c) antisymmetric.

See Solution

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p.604, icon at Example 10
#2. Let R be the following relation on the set of real numbers:

$$aRb \leftrightarrow \lfloor a \rfloor = \lfloor b \rfloor, \text{ where } \lfloor x \rfloor \text{ is the floor of } x.$$

Determine whether R is:

(a) reflexive. (b) symmetric. (c) antisymmetric.

See Solution

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p.604, icon at Example 10
#3. Let A be the set of all points in the plane with the origin removed. That is,

$$A = \{(x, y) | x, y \in \mathbf{R}\} - \{(0, 0)\}.$$

Define a relation R on A by the rule:

$$(a, b)R(c, d) \leftrightarrow (a, b) \text{ and } (c, d) \text{ lie on the same line through the origin.}$$

Determine whether R is:

(a) reflexive. (b) symmetric. (c) antisymmetric.

See Solution

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p.604, icon at Example 10
#4. Let $A = \{(x, y) | x, y \text{ integers}\}$. Define a relation R on A by the rule

$$(a, b)R(c, d) \leftrightarrow a \leq c \text{ and } b \leq d.$$

Determine whether R is:

(a) reflexive. (b) symmetric. (c) antisymmetric.

See Solution

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p.604, icon at Example 10
#5. Let $A = \{(x, y) | x, y \text{ integers}\}$. Define a relation R on A by the rule

$$(a, b)R(c, d) \leftrightarrow a = c \text{ or } b = d.$$

Determine whether R is:

(a) reflexive. (b) symmetric. (c) antisymmetric.

See Solution

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p.605, icon at Example 13
#1. Let R be the following relation defined on the set $\{a, b, c, d\}$:

$$R = \{(a, a), (a, c), (a, d), (b, a), (b, b), (b, c), (b, d), (c, b), (c, c), (d, b), (d, d)\}.$$

Determine whether R is transitive.

See Solution

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p.605, icon at Example 13
#2. Let R be the following relation on the set of real numbers:

$$aRb \leftrightarrow \lfloor a \rfloor = \lfloor b \rfloor, \text{ where } \lfloor x \rfloor \text{ is the floor of } x.$$

Determine whether R is transitive.

See Solution

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p.605, icon at Example 13
#3. Let A be the set of all points in the plane with the origin removed. That is,

$$A = \{(x, y) | x, y \in \mathbf{R}\} - \{(0, 0)\}.$$

Define a relation on A by the rule:

$$(a, b)R(c, d) \leftrightarrow (a, b) \text{ and } (c, d) \text{ lie on the same line through the origin.}$$

Determine if R is transitive.

See Solution

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p.605, icon at Example 13
#4. Let $A = \{(x, y) | x, y \text{ integers}\}$. Define a relation R on A by the rule

$$(a, b)R(c, d) \leftrightarrow a \leq c \text{ and } b \leq d.$$

Determine whether R is transitive.

See Solution

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p.605, icon at Example 13
#5. Let $A = \{(x, y) | x, y \text{ integers}\}$. Define a relation R on A by the rule

$$(a, b)R(c, d) \leftrightarrow a = c \text{ or } b = d.$$

Determine whether R is transitive.

See Solution

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Rosen, Discrete Mathematics and Its Applications, 8th edition
Extra Examples
Section 9.2–*n*-ary Relations and Their Applications.

Extra Examples — *Page references correspond to locations of Extra Examples icons in the textbook.*

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p. 613, icon at Example 5
#1. Consider the following table of planets of the solar system:

Name Mean Distance from the Sun (in AU) Number of Moons

Mercury 0.39 0

Venus 0.723 0

Earth 1 1

Mars 1.524 2

Jupiter 5.203 67

Saturn 9.539 62

Uranus 19.18 27

Neptun 30.06 13

Which one of the domains are primary keys for the relation displayed in the table?

See Solution

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p.613, icon at Example 7
#1. Consider the table of planets of the solar system again:

Name Mean Distance from the Sun (in AU) Number of Moons

Mercury 0.39 0

Venus 0.723 0

Earth 1 1

Mars 1.524 2

Jupiter 5.203 67

Saturn 9.539 62

Uranus 19.18 27

Neptun 30.06 13

If C is the condition (Mean Distance from the Sun < 10 ∧ Number of Moons > 2), and R is the relation represented by the table, what is the output of the selection operator s_C applied to R?

See Solution

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p.617, icon at Example 14
#1. In a given hour, a grocery store recorded the following transactions:

Transaction Number	Items
1	{ avocados, strawberries, tomatoes, peppers, salt }
2	{ red beans, avocados, tomatoes }
3	{ red beans, white beans, peppers }
4	{ avocados }
5	{ peppers, tomatoes }
6	{ salt }
7	{ strawberries, blueberries }
8	{ white beans, salt, avocados }
9	{ peppers, red beans }
10	{ avocados, tomatoes, peppers, salt }

1. Determine the count and the support of A = { salt } and B = { peppers, tomatoes }.
2. If we set the support treshold to 0.4, which are the frequent items and itemsets?

See Solution

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p.619, icon at Example 15

#1. In a given hour, a grocery store recorded the following transactions:

Transaction Number	Items
1	{ avocados, strawberries, tomatoes, peppers, salt }
2	{ red beans, avocados, tomatoes }
3	{ red beans, white beans, peppers }
4	{ avocados }
5	{ peppers, tomatoes }
6	{ salt }
7	{ strawberries, blueberries }
8	{ white beans, salt, avocados }
9	{ peppers, red beans }
10	{ avocados, tomatoes, peppers, salt }

For this set of transactions, find the support and the confidence of the association rule { avocados, tomatoes } $\rightarrow$ { salt }.

See Solution

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Extra Examples
Section 9.4—Closures of Relations

Extra Examples — *Page references correspond to locations of Extra Examples icons in the textbook.*

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p.629, icon at Example 2
#1. Let R be the relation on $\{1, 2, 3, 4\}$ such that

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

Find:

(a) the reflexive closure of R.
(b) the symmetric closure of R.
(c) the transitive closure of R.

See Solution

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Rosen, Discrete Mathematics and Its Applications, 8th edition
Extra Examples
Section 9.5—Equivalence Relations

Extra Examples — *Page references correspond to locations of Extra Examples icons in the textbook.*

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p.609, icon at Example 2
#1.

(a) Verify that the following is an equivalence relation on the set of real numbers:

$$aRb \leftrightarrow \lfloor a \rfloor = \lfloor b \rfloor, \text{ where } \lfloor x \rfloor \text{ is the floor of } x.$$

(b) Describe the equivalence classes arising from the equivalence relation in part (a).

See Solution

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p.609, icon at Example 2
#2. Let A be the set of all points in the plane with the origin removed. That is,

$$A = \{(x, y) | x, y \in \mathbf{R}\} - \{(0, 0)\}.$$

Define a relation on A by the rule:

$$(a, b)R(c, d) \leftrightarrow (a, b) \text{ and } (c, d) \text{ lie on the same line through the origin.}$$

(a) Prove that R is an equivalence relation.
(b) Describe the equivalence classes arising from the equivalence relation R in part (a).
(c) If A is replaced by the entire plane, is R an equivalence relation?

See Solution

p.641, icon at Example 9
#1. Let A be the set of real numbers, and R be the equivalence relation R where xRy if and only if x-y is an integer. (Example 2 in the textbook confirms that R is an equivalence relation.)

Find the equivalence classes of 0, 1, 1.5 and 1.7. How many equivalence classes are there?

See Solution

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p.641, icon at Example 9
#2. Let A be the set of real numbers, and R be the equivalence relation R where xRy if and only if x-y is a rational number.

1. Find the equivalence classes of 0, 1/2 and sqrt(2).
2. Are sqrt(2) and sqrt(3) in the same equivalence class or not?
3. How many equivalence classes are there?

See Solution

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Extra Examples
Section 9.6—Partial Orderings

Extra Examples — *Page references correspond to locations of Extra Examples icons in the textbook.*

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p.650, icon at Example 1
#1. Let $A = \{(x, y) | x, y \text{ integers}\}$. Define a relation R on A by the rule

$$(a, b)R(c, d) \leftrightarrow a \leq c \text{ or } b \leq d.$$

Determine whether R is a partial order relation on A.

See Solution

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p.650, icon at Example 1
#2. Let $A = \{(x, y) | x, y \text{ integers}\}$. Define a relation R on A by the rule

$$(a, b)R(c, d) \leftrightarrow a = c \text{ or } b = d.$$

Determine whether R is a partial order relation on A.

See Solution

p.650, icon at Example 4

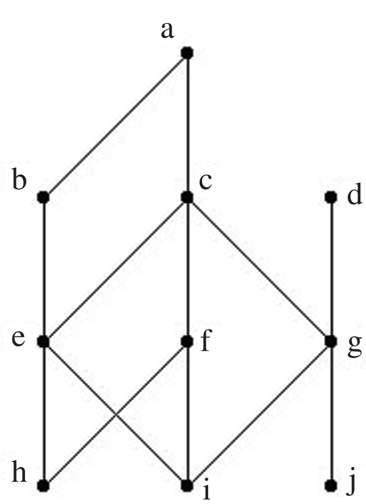
#1. Let R be the relation on the set of words in the English language where xRy if x precedes (that is, comes before) y in the dictionary. Show that R is not a partial ordering.

See Solution

p.658, icon at Example 20

#1. Referring to this Hasse diagram of a partially ordered set, find the following:

(a) all upper bounds of $\{d, e\}$.
(b) the least upper bound of $\{d, e\}$.
(c) all lower bounds of $\{a, e, g\}$.
(d) the greatest lower bound of $\{a, e, g\}$.
(e) greatest lower bound of $\{b, c, f\}$.
(f) least upper bound of $\{h, i, j\}$.
(g) greatest lower bound of $\{g, h\}$.
(h) least upper bound of $\{f, i\}$.



See Solution