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Quiz 3

Deadline	Wednesday, 23 June 2021 at 12:00PM
Latest Submission	Tuesday, 22 June 2021 at 11:35PM
Maximum Mark	10

Question 1 (1 mark)

Which of the following relations (over $\mathbb{N}$) are functions? (Select all that apply)

(a) ☑	The = relation
(b) ☐	The | relation
(c) ☐	The $\leq$ relation
(d) ☐	The relation $\{(n,m,n+m) : n,m \in \mathbb{N}\}$
(e) ☑	The relation $\{(n-1, n) : n \in \mathbb{N}_{>0}\}$
(f) ☐	The relation {}

Question 2 (1 mark)

True or false:

Over $\mathbb{Z}$, the relation defined by $(\leq \oplus \geq)$ is the same as the relation $\neq$?

(a) ◉	True
(b) ○	False

Question 3 (1 mark)

Let A = {a,b,c} and consider g:Pow(A)$\rightarrow\mathbb{N}$ given by g(X) = |X|.

What is Im(g)?

(a) ○	3
(b) ○	8
(c) ○	{3}
(d) ◉	{0,1,2,3}

Question 4 (1 mark)

Let $\Sigma = \{0,1\}$ and consider the relation on Σ^* given by $R = \{(w,v) : \text{length}(w) \geq 2 \cdot \text{length}(v)\}$

Which of the following properties does R satisfy? Select all that apply

(a) ☐	Reflexivity (R)
(b) ☐	Antireflexivity (AR)
(c) ☐	Symmetry (S)
(d) ☑	Antisymmetry (AS)
(e) ☑	Transitivity (T)

Question 5 (1 mark)

Consider the relation $R = \{(m,n) \in \mathbb{Z} \times \mathbb{Z} : m^2 \equiv_{(5)} n^2 \}$.

Which of the following properties does R satisfy? Select all that apply

(a) ☑	Reflexivity (R)
(b) ☐	Antireflexivity (AR)
(c) ☑	Symmetry (S)
(d) ☐	Antisymmetry (AS)
(e) ☑	Transitivity (T)

Question 6 (1 mark)

True or false:

$R \cup R^{\leftarrow}$ is an equivalence relation for any partial order R.

(a) ◉	True
(b) ○	False

Question 7 (1 mark)

Suppose R is a symmetric relation.

True or false: $R = R^{\leftarrow}$

(a) ◉	True
(b) ○	False

Question 8 (1 mark)

Consider $f:\mathbb{N}_{>0} \to \mathbb{N}_{>0}$ given by $f(x) = 2x+1$. What is the inverse image of $\{1,2,3\}$, i.e. what is $f^{\leftarrow}(\{1,2,3\})$?

(a) ○	$\{3,5,7\}$
(b) ○	$\{0,½,1\}$
(c) ○	$\{0,1\}$
(d) ○	$\{1\}$
(e) ◉	None of the above

Question 9 (1 mark)

Let $F = \mathbb{N}^{\mathbb{N}}$ denote the set of functions from $\mathbb{N}$ to $\mathbb{N}$. Define the relation R on F×F as follows:

$(f,g) \in R$ if $f(n) \neq g(n)$ for only finitely many $n \in \mathbb{N}$

Which of the following properties does R have? Select all that apply

(a) ☑	Reflexivity (R)
(b) ☐	Antireflexivity (AR)
(c) ☑	Symmetry (S)
(d) ☐	Antisymmetry (AS)
(e) ☑	Transitivity (T)

Question 10 (1 mark)

Let $F = \mathbb{N}^{\mathbb{N}}$ denote the set of functions from $\mathbb{N}$ to $\mathbb{N}$. Define the relation R on $F \times F$ as follows:

$(f,g) \in R$ if $f(n) \leq g(n)$ for infinitely many $n \in \mathbb{N}$

Which of the following properties does R have? Select all that apply

(a) ☑	Reflexivity (R)
(b) ☐	Antireflexivity (AR)
(c) ☐	Symmetry (S)
(d) ☐	Antisymmetry (AS)
(e) ☐	Transitivity (T)

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