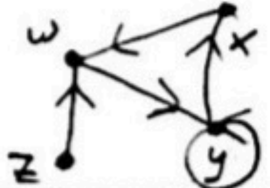
(4) The relation $R = \{(x,w),(y,x),(z,w),(y,y),(w,y)\}$ on the set $E = \{x,y,z,w\}$ is:

(a) not antisymmetric and not transitive.

(b) antisymmetric but not transitive.

(c) not antisymmetric and not reflexive.

(d) None of the previous.



(3) If R is a relation such that $xRy \leftrightarrow |x^2| < |y^2| \ \forall x, y \in \mathbb{Z}$, then R is:

(a) reflexive ✗

$|x^2| < |x^2|$

(b) antisymmetric

$|x^2| < |y^2| \wedge |y^2| < |x^2|$

impossible

(c) not transitive

(4)If A *and* B are subsets of the universal set U, such that $\bar{A} \cap B = B$, then

(a) $\bar{A} \subset B$ (b) $B \subset \bar{A}$ (c) $A = B$ (d) None of the previous

---

(5) If $R = \{(x, y) | x \geq y\}$, is a relation on $\mathbb{Z}$, then the symmetric closure of R is $R \cup R^{-1}$

(a)$\{(x, y)|x < y\}$(b) $\{(x, y)|x \leq y\}$(c) $\{(x, y)|x = y\}$ (d) None of the previous $x \geq y$ or $y \geq x$

$Z \times Z = R^2$ $Z \times Z$

5) If $A = \{1, 2, 3\}$ and $R = \{(1,1), (1,3), (2,1), (2,3), (3,2), (3,3)\}$, then the reflexive closure of R is

reflexive closure $R \cup \Delta = R \cup \{(1,1), (2,2), (3,3)\}$

(A)	(B)	(C)	(D)
$\{(1,1), (1,3), (2,1), (2,3), (3,1), (3,2), (3,3)\}$	$\{(1,1), (1,3), (2,1), (2,2), (2,3), (3,2), (3,3)\}$ ✓	$\{(1,1), (2,2), (3,3)\}$	None of the previous

4) The relation R, defined on $\mathbb{Z}$ by $xRy \iff |x^2| \leq |y^2|$ is

(A) antisymmetric	(B) reflexive	(C) symmetric	(D) None

5) Let $R_1 = \{(a,b) \in \mathbb{R}^2, a \neq b\}$ and $R_2 = \{(a,b) \in \mathbb{R}^2, a < b\}$. Then, $R_1 - R_2$ equals

(A) $\emptyset$	(B) R_1	(C) $\{(a,b) \in \mathbb{R}^2, a > b\}$	(D) None

5) Let U be the universal set and $R = \{(A, B) \in \mathcal{P}(U) : A \cap B = \emptyset\}$. Then

ϕ

xive

$A \cap B = \phi \Rightarrow B \cap A = \phi$

Symmetric

$A \cap B = \phi \wedge B \cap C = \phi \not\Rightarrow A \cap C = \phi$

(A) R is reflexive ✗	(B) R is not ✗ symmetric	(C) R is not transitive ✓	(D) None

6) Let $R = \{(a, b) : \lvert a - b \rvert < 5\}$ be a relation defined on $\mathbb{R}$. Then,

$b| < 5$

< 5

(A) R is reflexive and transitive ✗	(B) R is symmetric and not transitive ✓	(C) R is not reflexive and not transitive	(D) None

$a > b$ or $a < b$ مشترك

7) Let $R_1 = \{(a, b) \in \mathbb{R}^2 : a \neq b\}$ and $R_2 = \{(a, b) \in \mathbb{R}^2 : a < b\}$. Then, $R_1 - R_2$ equals

(A) $\emptyset$	(B) R_1	(C) $\{(a, b) \in \mathbb{R}^2 : a > b\}$	(D) None

9) If $R = \{(1,1),(2,2),(3,3)\}$ and $S = \{(1,1),(1,2),(1,3),(1,4)\}$, then $S \circ R$ is

,(1,2),(1,3),(1,4)}

(A) S	(B) R	(C) $\emptyset$	(D) None

10) The inverse of relation $R = \{(a,b) | a > b\}$ is

b>a

(A) $R^{-1} = \{(a,b) \| a < b\}$	(B) $R^{-1} = \{(a,b) \| a \leq b\}$	(C) $R^{-1} = \{(a,b) \| a \geq b\}$	(D) None

(2) The transitive closure of the relation $R = \{(1,1),(1,2),(3,1)\}$ defined on the set $A = \{1,2,3\}$ equals:

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

$R^3 = R^2 \circ R = \{(1,1),(1,2),(3,1),(3,2)\}$

$R^* = \bigcup_{n=1}^{3} R^n = R^2$

(a) R (b) R^2 (c) $A \times A$ (d) None of the previous

A. Choose the correct answer, then fill in the table above:

(1) If $R = \{(x,y),\ x > y\}$, then $R^{-1} = \xrightarrow{y\,,\,x}$ نبدل أماكن

(a) $\{(x,y),\ x \leq y\}$ ✓ (b) $\{(x,y),\ x < y\}$ (c) $\{(x,y),\ x = y\}$ (d) None of the previous

(2) Let S be a relation such that aSb *if and only if* $b = a + 4$ defined from the set $A = \{1, 2, 4\}$ to $B = \{2,6,8,10\}$, then S equals:

✓(a) $\{(2,6), (4,8)\}$ (b) $\{(1,2), (2,2), (4,8)\}$ (c) $\emptyset$ (d) None of the previous

---

(3) If R is an equivalence relation and xRy, then

i) xRy
ii) $[x] = [y]$
iii) $[x] \cap [y] \neq \phi$

(a) $[x] \cap [y] = \emptyset$ ✓(b) $[x] = [y]$ (c) $[x] \neq [y]$ (d) None of the previous

---

(4) If R is a the relation $R = \{(x, y) \mid |x| < |y|\}$ defined on $\mathbb{Z}$, then R is:

(a) reflexive ✓(b) antisymmetric (c) not transitive (d) None of the previous

---

2)

$1R2$ ✗ ($2=1+4$?)	$2R2$ ✗	$4R2$ ✗
$1R6$ ✗	$2R6$ ✓	$4R6$ ✗
$1R8$ ✗	$2R8$ ✗	$4R8$ ✓
$1R10$ ✗	$2R10$ ✗	$4R10$ ✗

4) $xRy \leftrightarrow |x| < |y|$

1) Since $|x| \not< |x|$ not reflexive.

2) $\underbrace{|x| < |y| \wedge |y| < |x|}_{\text{impossible}} \longrightarrow$ antisymmetric

$2=2^1 \quad 4=2^2 \quad 8=2^3 \quad 16=2^4$

(2) The set $\{(1,2),(2,4),(3,8),(4,16)\}$ represents the relation

(a) $xRy \Leftrightarrow x+2<y$

(b) $xRy \Leftrightarrow y=2^x$

(c) $xRy \Leftrightarrow x+y \text{ is odd}$

(d) None of the previous

$2=2^1 \quad 4=2^2 \quad 8=2^3 \quad 16=2^4$

(2) The set $\{(1,2),(2,4),(3,8),(4,16)\}$ represents the relation

(a) $xRy \Leftrightarrow x+2<y$

✓ (b) $xRy \Leftrightarrow y=2^x$

(c) $xRy \Leftrightarrow x+y$ *is odd*

(d) None of the previous

---

(3) Let $R_1 = \{(a,b) \in \mathbb{R}^2 : a=b\}$ and $R_2 = \{(a,b) \in \mathbb{R}^2 : a>b\}$, then $R_1 \cap R_2 =$

✓ (a) ϕ (b) R_1 (c) R_2 (d) None of the previous

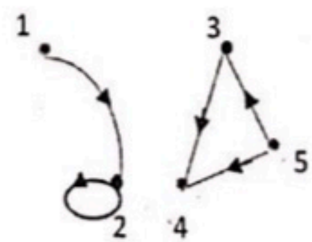
---

(4) In the poset $(\mathbb{Z}, \geq)$, any two elements are comparable

✓ (a) True (b) False (c) None of the previous

---

(5) The relation R, defined on $\{1,2,3,4,5\}$ whose graph is below, is



(a) reflexive (b) symmetric ✓ (c) transitive (d) None of the previous

a) an equivalence relation   b) a partial order relatio   c) not antisymmetric

2) If R is a relation on Z defined by $xRy \Leftrightarrow |x| \leq |y|$, then R is

a) an equivalence relation   b) not antisymmetric   c) none

3) If $\{K, L, M\}$ is a partition of a set A, then the following set is partition of A,

a) $\{\overline{K}, \overline{L}, \overline{M}\}$ b) $\{K - L, L - M, M - K\}$ c) none

1) If $R_1 = \{(a,b) \in \mathbb{R}^2 : a \leq b\}$ and $R_2 = \{(a,b) \in \mathbb{R}^2 : a < b\}$, then $R_1 - R_2$ is

(A)	(B)	(C)	(D)
R_1	$\{(a,b) \in \mathbb{R}^2 : a = b\}$	$\{(a,b) \in \mathbb{R}^2 : a \neq b\}$	None of the previous

2) The reflexive closure of relation $R = \{(1,2),(2,1),(2,3)\}$, defined on set $A = \{1,2,3\}$ is

(A)	(B)	(C)	(D)
$\{(1,2),(2,1)\}$	$\{(2,3)\}$	$\{(1,1),(1,2),(2,1),(2,2)(2,3),(3,3)\}$	None of the previous

3) Let R be defined on $A = \{1,2,3,4\}$ by $R = \{(1,2),(1,3),(1,4),(2,3),(2,4),(3,4)\}$.

(A)	(B)	(C)	(D)
R is symmetric and reflexive	R is transitive and antisymmetric	R is reflexive and transitive	None of the previous

2

3

4) If R is defined on $\mathbb{Z}$ by $aRb \Leftrightarrow a^2 = b^2$, then, for every $a \in \mathbb{Z}$,

(A)	(B)	(C)	(D)
$[a] \cap [-a] = \emptyset$	$[a] = \emptyset$	$[a] = [-a]$	None of the previous

... the Hasse diagram of the relation