

Practice Problems (Relations)

- Q.1 The number of relations on a n element set is:
(A) 2^{n^2} (B) $2^{n(n-1)}$ (C) $2^{\frac{n(n+1)}{2}}$ (D) $3^{\frac{n(n-1)}{2}}$
- Q.2 The number of relations on a n element set that are reflexive is:
 (A) 2^{n^2} **(B) $2^{n(n-1)}$** (C) $2^{\frac{n(n+1)}{2}}$ (D) $3^{\frac{n(n-1)}{2}}$
- Q.3 The number of relations on a n element set that are symmetric is:
 (A) 2^{n^2} (B) $2^{n(n-1)}$ **(C) $2^{\frac{n(n+1)}{2}}$** (D) $3^{\frac{n(n-1)}{2}}$
- Q.4 The number of relations on a n element set that are asymmetric:
 (A) 2^{n^2} (B) $2^{n(n-1)}$ (C) $2^{\frac{n(n+1)}{2}}$ **(D) $3^{\frac{n(n-1)}{2}}$**
- Q.5 The number of relations on a n element set that are antisymmetric:
(A) $2^n 3^{\frac{n(n-1)}{2}}$ (B) $2^{n(n-1)}$ (C) $2^{\frac{n(n+1)}{2}}$ (D) $3^{\frac{n(n-1)}{2}}$
- Q.6 The number of relations on a n element set that are irreflexive is:
 (A) 2^{n^2} **(B) $2^{n(n-1)}$** (C) $2^{\frac{n(n+1)}{2}}$ (D) $3^{\frac{n(n-1)}{2}}$
- Q.7 The number of relations on a n element set that are not reflexive is:
(A) $2^{n(n-1)}(2^n - 1)$ (B) $2^{n(n-1)}$ (C) $2^{\frac{n(n+1)}{2}}$ (D) $3^{\frac{n(n-1)}{2}}$
- Q.8 How many relations are there on the power set of $X = \{\phi\}$?
 (A) 2^4 (B) 2^2 **(C) 2^{16}** (D) 2^8
- Q.9 Let R be the relation on the set of real numbers given by xRy if and only if $x < y + 1$.
 (A) Reflexive, but not symmetric and not transitive.
 (B) Reflexive, symmetric and not transitive.
 (C) Not Reflexive, not symmetric and not transitive.
(D) Reflexive, but not symmetric and transitive.
- Q.10 Define a relation on the integers by aRb if $|a - b| < 5$. Choose the most complete correct statement from the following:
 (A) R is transitive **(B) R is reflexive and symmetric**
 (C) R is reflexive and transitive (D) R is symmetric and transitive

Determine which of the following properties applies to each relation.

- (i) Reflexive
- (ii) Irreflexive
- (iii) Symmetric
- (iv) Antisymmetric
- (v) Asymmetric
- (vi) Transitive

- Q.11 Let R be the relation on N given by xRy iff x divides y .
- (A) (i) and (vi) only (B) (i), (iii) and (vi) only
- (C) (i), (iv) and (vi) only (D) (ii), (v), (vi) only
- Q.12 Let X be a set and let R be the relation " \subseteq " defined on subsets of X .
- (A) (i) and (vi) only (B) (i), (iv) and (vi) only
- (C) (ii) and (iv) only (D) (i) only
- Q.13 Let R be the relation on the real numbers given by xRy iff $x - y$ is rational.
- (A) (i) and (vi) only (B) (i), (iii) and (vi) only
- (C) (ii) and (iv) only (D) (ii), (iv), (v) only
- Q.14 Let R be the relation on the real numbers given by xRy iff $x - y$ is irrational.
- (A) (i) and (iii) only (B) (i), (iv) and (vi) only
- (C) (ii), (iv) and (v) only (D) (ii) and (iii) only
- Q.15 Let R be the relation on the real numbers given by xRy iff $(x - y)^2 < 0$.
- (A) (ii) and (vi) only (B) (i), (iv) and (vi) only
- (C) (ii), (iii) and (vi) only (D) (ii), (iii), (iv), (v) and (vi) only

True or False

1. A relation which is not reflexive is always irreflexive. (False)
2. The properties of being symmetric and anti-symmetric are not negatives of each other. (True)
3. Empty set is a relation (True)
4. Asymmetric implies irreflexive (True)
5. Asymmetric implies antisymmetric (True)
6. A relation can be simultaneously Symmetric and antisymmetric (True)
7. Symmetric and antisymmetric implies transitive (True)
8. A relation can simultaneously be both reflexive and ir-reflexive (True)
9. reflexive and irreflexive implies all properties (True)
10. Empty relation ϕ is symmetric, antisymmetric, asymmetric, transitive, irreflexive and may or may not be reflexive depending upon the domain. (True)