CHECK YOUR GRASP — RELATIONS — EXERCISE-I

1. If R is a relation from a finite set A having m elements to a finite set B having n elements, then the number of relations from A to B is-
(1) 2^{mn} (2) $2^{mn}-1$ (3) 2mn (4) m^n

2. In the set A = {1, 2, 3, 4, 5}, a relation R is defined by R = {(x, y) | x, y ∈ A and x < y}. Then R is-
(1) Reflexive (2) Symmetric
(3) Transitive (4) None of these

3. For real numbers x and y, we write $x\,R\,y \Leftrightarrow x - y + \sqrt{2}$ is an irrational number. Then the relation R is-
(1) Reflexive (2) Symmetric
(3) Transitive (4) none of these

4. Let X = {1, 2, 3, 4} and Y = {1, 3, 5, 7, 9}. Which of the following is relations from X to Y-
(1) R_1 = {(x, y) | y = 2 + x, x ∈ X, y ∈ Y}
(2) R_2 = {(1, 1), (2, 1), (3, 3), (4, 3), (5, 5)}
(3) R_3 = {(1, 1), (1, 3), (3, 5), (3, 7), (5, 7)}
(4) R_4 = {(1, 3), (2, 5), (2, 4), (7, 9)}

5. Let L denote the set of all straight lines in a plane. Let a relation R be defined by $\alpha\,R\,\beta \Leftrightarrow \alpha \perp \beta$, $\alpha, \beta \in L$. Then R is-
(1) Reflexive (2) Symmetric
(3) Transitive (4) none of these

6. Let R be a relation defined in the set of real numbers by $a\,R\,b \Leftrightarrow 1 + ab > 0$. Then R is-
(1) Equivalence relation (2) Transitive
(3) Symmetric (4) Anti-symmetric

7. Which one of the following relations on R is equivalence relation-
(1) $x\,R_1 y \Leftrightarrow |x| = |y|$ (2) $x\,R_2 y \Leftrightarrow x \geq y$
(3) $x\,R_3 y \Leftrightarrow x \mid y$ (4) $x\,R_4 y \Leftrightarrow x < y$

8. Two points P and Q in a plane are related if OP = OQ, where O is a fixed point. This relation is-
(1) Reflexive but symmetric
(2) Symmetric but not transitive
(3) An equivalence relation
(4) none of these

9. The relation R defined in A = {1, 2, 3} by a R b if $|a^2 - b^2| \leq 5$. Which of the following is false-
(1)R ={(1, 1), (2, 2), (3, 3), (2, 1), (1, 2), (2, 3), (3, 2)
(2) $R^{-1} = R$
(3) Domain of R = {1, 2, 3}
(4) Range of R = {5}

10. Let a relation R is the set N of natural numbers be defined as (x, y) ∈ R if and only if $x^2 - 4xy + 3y^2 = 0$ for all x, y ∈ N. The relation R is-
(1) Reflexive
(2) Symmetric
(3) Transitive
(4) An equivalence relation

11. Let A = {2, 3, 4, 5} and let R = {(2, 2), (3, 3), (4, 4), (5, 5), (2, 3), (3, 2), (3, 5), (5, 3)} be a relation in A. Then R is-
(1) Reflexive and transitive
(2) Reflexive and symmetric
(3) Reflexive and antisymmetric
(4) none of these

12. If A = {2, 3} and B = {1, 2}, then A B is equal to-
(1) {(2, 1), (2, 2), (3, 1), (3, 2)}
(2) {(1, 2), (1, 3), (2, 2), (2, 3)}
(3) {(2, 1), (3, 2)}
(4) {(1, 2), (2, 3)}

13. Let R be a relation over the set N N and it is defined by (a, b) R (c, d) ⇒ a + d = b + c. Then R is-
(1) Reflexive only
(2) Symmetric only
(3) Transitive only
(4) An equivalence relation

14. Let N denote the set of all natural numbers and R be the relation on N N defined by (a, b) R (c, d) if ad (b + c) = bc(a + d), then R is-
(1) Symmetric only
(2) Reflexive only
(3) Transitive only
(4) An equivalence relation

15. If A = {1, 2, 3}, B = {1, 4, 6, 9} and R is a relation from A to B defined by 'x is greater than y'. Then range of R is-
(1) {1, 4, 6, 9} (2) {4, 6, 9}
(3) {1} (4) none of these

16. Let L be the set of all straight lines in the Euclidean plane. Two lines ℓ_1 and ℓ_2 are said to be related by the relation R if ℓ_1 is parallel to ℓ_2. Then the relation R is-
(1) Reflexive (2) Symmetric
(3) Transitive (4) Equivalence

17. A and B are two sets having 3 and 4 elements respectively and having 2 elements in common. The number of relations which can be defined from A to B is-

(1) 2^5 (2) $2^{10} - 1$

(3) $2^{12} - 1$ (4) none of these

18. For n, m ∈ N, n|m means that n is a factor of m, the relation | is-

(1) reflexive and symmetric

(2) transitive and symmetric

(3) reflexive, transitive and symmetric

(4) reflexive, transitive and not symmetric

19. Let R = {(x, y) : x, y ∈ A, x + y = 5} where A = {1, 2, 3, 4, 5} then

(1) R is not reflexive, symmetric and not transitive

(2) R is an equivalence relation

(3) R is reflexive, symmetric but not transitive

(4) R is not reflexive, not symmetric but transitive

20. Let R be a relation on a set A such that $R = R^{-1}$ then R is-

(1) reflexive

(2) symmetric

(3) transitive

(4) none of these

21. Let x, y ∈ I and suppose that a relation R on I is defined by x R y if and only if x ≤ y then

(1) R is partial order ralation

(2) R is an equivalence relation

(3) R is reflexive and symmetric

(4) R is symmetric and transitive

22. Let R be a relation from a set A to a set B, then-

(1) R = A ∪ B (2) R = A ∩ B

(3) R ⊆ A B (4) R ⊆ B A

23. Given the relation R = = {(1, 2), (2, 3)} on the set A = {1, 2, 3}, the minimum number of ordered pairs which when added to R make it an equivalence relation is-

(1) 5 (2) 6 (3) 7 (4) 8

24. Let P = {(x, y) | $x^2 + y^2 = 1$, x, y ∈ R} Then P is-

(1) reflexive (2) symmetric

(3) transitive (4) anti-symmetric

25. Let X be a family of sets and R be a relation on X defined by 'A is disjoint from B'. Then R is-

(1) reflexive (2) symmetric

(3) anti-symmetric (4) transitive

26. In order that a relation R defined in a non-empty set A is an equivalence relation, it is sufficient that R

(1) is reflexive

(2) is symmetric

(3) is transitive

(4) possesses all the above three properties

27. If R be a relation '<' from A = {1, 2, 3, 4} to B = {1, 3, 5} i.e. (a, b) ∈ R iff a < b, then ROR^{-1} is-

(1) {(1, 3), (1, 5), (2, 3), (2, 5), (3, 5), (4, 5)}

(2) {(3, 1), (5, 1), (3, 2), (5, 2), (5, 3), (5, 4)}

(3) {(3, 3), (3, 5), (5, 3), (5, 5)}

(4) {(3, 3), (3, 4), (4, 5)}

28. If R is an equivalence relation in a set A, then R^{-1} is-

(1) reflexive but not symmetric

(2) symmetric but not transitive

(3) an equivalence relation

(4) none of these

29. Let R and S be two equivalence relations in a set A. Then-

(1) R ∪ S is an equivalence relation in A

(2) R ∩ S is an equivalence relation in A

(3) R – S is an equivalence relation in A

(4) none of these

30. Let A = {p, q, r}. Which of the following is an equivalence relation in A ?

(1) R_1 = {(p, q), (q, r), (p, r), (p, p)}

(2) R_2 = {(r, q) (r, p), (r, r), (q, q)}

(3) R_3 = {(p, p), (q, q), (r, r), (p, q)}

(4) none of these

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	1	3	1	1	2	3	1	3	4	1	2	1	4	4	3
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	4	4	4	1	2	1	3	3	2	2	4	3	3	2	4

PREVIOUS YEAR QUESTIONS RELATIONS EXERCISE-II

1. Let R = {(1, 3), (4, 2), (2, 4), (2, 3), (3, 1)} be a releation on the set A = {1, 2, 3, 4}. The relation R is- **[AIEEE - 2004]**

(1) transitive (2) not symmetric

(3) reflexive (4) a function

2. Let R = {(3, 3), (6, 6), (9, 9), (12, 12), (6, 12), (3, 9), (3, 12), (3, 6)} be relation on the set A = {3, 6, 9, 12). The relation is- **[AIEEE - 2005]**

(1) rflexive and transitive only

(2) reflexive only

(3) an equilvalence relation

(4) reflexive and symmetric only

3. Let W denote the words in the English dictionary. Define the relation R by : R = {(x, y) ∈ W W| the words x and y have at least one letter in common}. Then R is- **[AIEEE - 2006]**

(1) reflexive, symmetric and not transitive

(2) reflexive, symmetric and transitive

(3) reflexive, not symmetric and transtive

(4) not reflexive, symmetric and transitive

4. Consider the following relations :-

R = {(x, y) | x, y are real numbers and x = wy for some rational number w} ;

$S = \{(\frac{m}{n}, \frac{p}{q})$ | m, n, p and q are integers such that

$n, q \neq 0$ and qm = pn}.

Then : **[AIEEE - 2010]**

(1) R is an equivalence relation but S is not an equivalence relation

(2) Neither R nor S is an equivalence relation

(3) S is an equivalence relation but R is not an equivalence relation

(4) R and S both are equivalence relations

5. Let R be the set of real numbers.

Statement-1:

A = {(x, y) ∈ R R : y − x is an integer} is an equivalence relation on R. **[AIEEE - 2011]**

Statement-2:

B = {(x, y)∈ R R : x = αy for some rational number α} is an equivalence relation on R.

(1) Statement-1 is true, Statement-2 is false.

(2) Statement-1 is false, Statement-2 is true

(3) Statement-1 is true, Statement-2 is true; Statement-2 is a correct explanation for Statement-1

(4) Statement-1 is true, Statement-2 is true; Statement-2 is **not** a correct explanation for Statement-1.

6. Consider the following relation R on the set of real square matirces of order 3.

R={(A, B)|A=P^{-1} BP for some invertible matrix P}.

Statement - 1:

R is an equivalence relation.

Statement - 2:

For any two invertible 3 3 martices M and N, $(MN)^{-1} = N^{-1}M^{-1}$ **[AIEEE - 2011]**

(1) Statement-1 is false, statement-2 is true.

(2) Statement-1 is true, statement-2 is true; Statement-2 is correct explanation for statement-1.

(3) Statement-1 is true, statement-2 is true; Statement-2 is not a correct explanation for statement-1.

(4) Statement-1 is true, statement-2 is false.

ANSWER KEY

Que.	1	2	3	4	5	6									
Ans.	2	1	1	3	1	1									