Chapter 02

Sets and Relations

🏆 RANKER'S STUFF 🏆

Q.1 If A, B and C are any three sets, then $A - (B \cup C)$ is equal to
(1) $(A - B) \cup (A - C)$ (2) $(A - B) \cup C$
(3) $(A - B) \cap (A - C)$ (4) $(A - B) \cap C$

Q.2 If A, B and C are any three sets, then $A - (B \cap C)$ is equal to
(1) $(A - B) \cup C$ (2) $(A - B) \cap (A - C)$
(3) $(A - B) \cup (A - C)$ (4) $(A - B) \cap C$

Q.3 A set contains $2n + 1$ elements. The number of subsets of this set containing more than n elements is equal to
(1) 2^{n-1} (2) 2^n (3) 2^{2n} (4) 2^{n+1}

Q.4 The set $(A \cap B^c)^c \cup (B \cap C)$ is equal to -
(1) $A \cup B \cup C$ (2) $A^c \cup B$
(3) $A^c \cup B^c$ (4) None

Q.5 Sets A and B have 3 and 6 elements respectively. What can be the minimum number of elements in $A \cup B$?
(1) 3   (2) 6   (3) 9   (4) 18

Q.6 Let X = {1, 2, 3, 4, 5, 6} be a universal set. Sets A, B, C in the universal set X be defined by A = {1, 2, 3}, B = {2, 4, 5} & C = {3, 4, 5, 6}. Then incorrect options is
(1) $A \cap C' = \{1, 2\}$
(2) $(A - B) \cup (B - A) = \{1, 3, 4, 5\}$
(3) $(A - B) - C = \{1\}$
(4) $A - B = \{4, 5\}$

Q.7 Let S = { 1, 2, 3, 4, 5} and A = S × S . A relation R is defined on A as follows:
'' (a, b) R (c, d) iff ad = cb ''. then R is
(1) Reflexive   (2) Symmetric
(3) Transitive   (4) Equivalence relation

Q.8 If A, B and C are any three sets, then $A \times (B \cap C)$ is -
(1) $(A \times B) \cup (A \times C)$ (2) $(A \times B) \cap (A \times C)$
(3) $(A \cup B) \times (A \cup C)$ (4) $(A \cap B) \times (A \cap C)$

Q.9 The relation "congruence modulo m" is
(1) Reflexive only
(2) Transitive only
(3) An equivalence relation
(4) Symmetric only

Q.10 Let R : $\Delta \to \Delta$, where Δ is set of all triangles such that Δ_1 R $\Delta_2 \Rightarrow \Delta_1$ is congruent to Δ_2 then 'R' is-
(1) Reflexive   (2) Symmetric
(3) Transitive   (4) Equivalence relation

Q.11 Let R : A $\to$ A, A is set of all children in a family such that xRy $\Rightarrow$ x is brother of 'y' (where x, y $\in$ A), then R is-
(1) Reflexive   (2) Symmetric
(3) Transitive   (4) Equivalence relation

Q.12 Let A and B be two non–empty subsets of set X such that A is not a subset of B, then-
(1) A is subset of B'
(2) $B \subseteq A$
(3) A and B' are non-disjoint
(4) A and B are disjoint

Q.13 The void relation on a set A is-
(1) Reflexive
(2) Symmetric and transitive
(3) Reflexive and symmetric
(4) Reflexive and transitive

Q.14 Let X = {1, 2, 3, 4, 5} and Y = {1, 3, 5, 7, 9}. Which of the following is not relation from X to Y-
(1) $R_1 = \{(x, y) \mid y = 2 + x, x \in X, y \in Y\}$

(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, 9)}

Q.15 Let R be a relation defined in the set of real numbers by aRb $\Leftrightarrow$ 1 + ab > 0. Then R is-

(1) Equivalence relation

(2) Transitive

(3) Symmetric

(4) Anti-symmetric

Q.16 Let A = { (x, y) : $a^x = a^y$; a > 0 and a $\neq$ 1; a, x, y $\in$ R }

B = { (x, y) : xy = 1 ; x, y $\in$ R_0}

Choose the correct statement amongst the following.

(1) A $\cap$ B = B

(2) A $\cap$ B = A

(3) n(B) > n(A)

(4) A and B are non-comparable

Q.17 Let R be a relation in N defined by

R = {(1+ x, 1+ x^2): x $\leq$ 5, x $\in$ N}.

Which of the following is false -

(1) R = {(2, 2), (3, 5), (4, 10), (5, 17), (6, 25)}

(2) Domain of R = {2, 3, 4, 5, 6}

(3) Range of R = {2, 5, 10, 17, 26}

(4) None of these

Q.18 The relation R defined in A = {1, 2, 3} by aRb 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}

Q.19 Let a relation R in the set N of natural numbers be defined as (x, y) $\in$ R if and only if $x^2 - 4xy + 3y^2 = 0$ for all x, y $\in$ N. The relation R is -

(1) Reflexive

(2) Symmetric

(3) Transitive

(4) An equivalence relation

Q.20 Solution set of x $\equiv$ 3 (mod 7), p $\in$ Z, is given by

(1) {3}

(2) {7p $-$ 3 : p $\in$ Z}

(3) {7p $+$ 3 : p $\in$ Z}

(4) None of these

Q.21 Let R be a relation on set of Real numbers defined by

R = { (x, y): y = | x -1|+|x $-$ 2|, 0 $\leq$ x $\leq$ 3}

then range of R.

(1) [1,3]   (2) (1,3)   (3) [0, 4]   (4) [1,4]

Q.22 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

Q.23 In a college of 300 students, every students reads 5 newspapers and every newspaper is read by 60 students. The number of newspapers is-

(1) at least 30

(2) at most 20

(3) exactly 25

(4) none of these

Q.24 If A = {1, 2, 3, 4, 5}, then the number of proper subsets of A is -

(1) 120   (2) 30   (3) 31   (4) 32

NUMERICAL TYPE QUESTIONS

Q.25 Out of 800 boys in a school, 224 played cricket, 240 played hockey and 336 played basketball. Of the total, 64 played both basketball and hockey; 80 played cricket and basketball and 40 played cricket and hockey; 24 played all the three games. The number of boys who did not play any game is_____.

Q.26 If *A* is the set of even natural numbers less than 8 and *B* is the set of prime numbers less than 7, then the number of relations from *A* to *B* is_____.

Q.27 In a battle 70% of the combatants lost one eye, 80% an ear, 75% an arm, 85% a leg, *x*% lost all the four limbs. The minimum value of *x* is_____.

Q.28 The number of reflexive relations of a set with four elements is equal to_____.

Q.29 If $A = \{ x \in R : |x - 2| > 1,$ $B = \{ x \in R : \sqrt{x^2 - 3} > 1\},$ $C = \{x \in R : |x - 4| \geq 2\}$ and N is the set of all Natural numbers then the number of subsets of the set $(A \cap B \cap C)^c \cap N$ is–

Q.30 Set A has m elements and set B has n elements if the total number of subsets of A is 192 less than the total number of subsets of B, then the value of $|m - n| + m \cdot n$ will be-

Q.31 Let $A = \{ n \in N \,|\, n^2 \leq n + 10{,}000\}, B = \{ 3k + 1 \,|\, k \in N \}$ and $C = \{ 2k \,|\, k \in N \}$ then the sum of all the elements of the set $A \cap (B - C)$ is equal to-

Q.32 The number of elements in the set $\{ n \in \{ 1, 2, 3....100\} \,|\, (11)^n > (10)^n + 9^n \}$ is-

Q.33 Let $A = \{ n \in N : n$ is a 3 digit number $\}$
$B = \{ 9k + 2 : k \in N\}$
and $C = \{ 9k + \lambda : k \in N\}$ for some $(0 < \lambda < 9)$. if the sum of all elements of the set $A \cap (B \cup C)$ is 274×400, then λ is equal to-

Q.34 Let $S = \{1, 2, 3, 4, 5, 6, 9,\}$. Then the number of elements in the set $T = \{A \subseteq S : A \neq \phi$ and the sum of all the elements of A is not a multiple of 3$\}$ is _____.

Each of the questions given below consist of Statement -I and Statement- II. Use the following key to choose the appropriate answer.

(A) Both Statement-I Statement-II are true, and Statement-II is the correct explanation of Statement-I.

(B) Both Statement-I and Statement-II are true but Statement-II is not the correct explanation of Statement-I

(C) Statement-I is true but Statement-II is false

(D) Statement-I is false but Statement-II is true.

Q.35 Let R be the set of real numbers.
Statement-I:
$A = \{(x,y) \in R \times R : y - x \text{ is an integer}\}$ is an equivalence relation on R.
Statement-II:

$B = \{(x,y) \in R \times R : x = \alpha y$ for some rational number $\alpha\}$ is an equivalence relation on R.
(1) A   (2) B   (3) C   (4) D

Q.36 Consider the following relation R on the set of real square matrices of order 3.
$R = \{(A, B) \,|\, A = P^{-1} BP$ for some invertible matrix P$\}$.
Statement -I: R is equivalence relation.
Statement-II: For any two invertible 3×3 matrices M and N, $(MN)^{-1} = N^{-1} M^{-1}$.
(1) A   (2) B   (3) C   () D

MORE THAN ONE CORRECT TYPE QUESTIONS

Q.37 Let $A = \{1, 2, 3, 4\}$ and R be a relation in A given by $R = \{(1, 1), (2, 2), (3, 3), (4, 4), (1, 2), (2, 1), (3, 1), (1, 3)\}$, then relation R is
(1) Reflexive
(2) Symmetric
(3) Equivalence
(4) Reflexive and Symmetric

Q.38 In a survery, it was found that 21 persons liked product A, 26 liked product B and 29 liked product C. If 14 persons liked products A and B, 12 liked products C and A, 13 persons liked products B and C and 8 liked all the three products then which of the following is (are) true ?
(1) The number of persons who liked the product C only = 12
(2) The number of persons who like the products A and B but not C = 6
(3) The number of persons who liked the product C only = 6
(4) The number of persons who like the products A and B but not C = 12

Q.39 For n, m $\in$ N, n | m means that n is a factor of m, then relation | is
(1) Reflexive   (2) symmetric
(3) Transitive   (4) Equivalence

COMPREHENTION TYPE QUESTIONS

Q.40 In a group of 1000 people, there are 750 people, who can speak Hindi and 400 people, who can speak Bengali.

(i) Number of people who can speak Hindi only is

(1) 300   (2) 400   (3) 500   (4) 600

(ii) Number of people who can speak Bengali only is

(1) 150   (2) 250   (3) 50   (4) 100

(iii) Number of people who can speak both Hindi and Bengali is

(1) 50   (2) 100   (3) 150   (4) 200

Q.41 Let R be a relation defined as R = { (x, y) : y = $\sqrt{(x-1)^2}$, x $\in$ Z and $-3 \le x \le 3$}

(i) Relation R is equal to :

(1) {(1, 0), (1, 2), (3, 2), (4, 3)}

(2) {(–3, 4), (–2, 3), (–1, 2), (0, 1), (1, 0), (2, 1), (3, 2)}

(3) {(4, –3), (3, –2), (2 –1), (1, 0), (2, 3)}

(4) None of these

(ii) Domain of R is :

(1) {0, 1, 2, 3, 4}

(2) {1, 3, 4}

(3) {– 3, – 2, – 1, 0, 1, 2, 3}

(4) {0, 1, 2, 3, 4}

(iii) Range of R is

(1) {0, 1, 2, 3, 4}

(2) {–3, –2, –1, 0, 1, 2, 3}

(3) {–4, –3, –1, –2, 0}

(4) {–1, 0, 1, 2, 3, 4}

MATCH THE COLUMN TYPE QUESTIONS

Q.42 Match the column

	Column–I		Column–II
(1)	$\{3^{2n} - 8n - 1 : n \in N\}$	(P)	$\{49(n-1) : n \in N$
(2)	$\{2^{3n} - 1 : n \in N\}$	(Q)	$\{64(n-1) : n \in N\}$
(3)	$\{3^{2n} - 1 : n \in N\}$	(R)	$\{7n : n \in N\}$
(4)	$\{2^{3n} - 7n - 1 : n \in N\}$	(S)	$\{8n : n \in N\}$

Q.43 Match the relation defined on set A = {a,b,c} in column I with the corresponding type in column II

	Column–I		Column–II
(1)	{a,b), (b,a)	(P)	symmetric but not reflexive and transitive
(2)	{(a,b), (b,a), (a,a), (b,b)}	(Q)	equivalence
(3)	{(a,b), (b,c), (a,c)}	(R)	symmetric and transitive but not reflexive
(4)	{(a,a), (b,b), (c,c)}	(S)	transitive but not reflexive and symmetric

ANSWER KEY

JEE-FLASHBACK
JEE-MAINS QUESTIONS

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	2	1	1	3	2	2	2	2	2	4	4	4	2	2	4
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	2	4	1	3	1	4	4	3	107	112	4	4	4	2	1
Que.	31	32	33	34	35	36	37								
Ans.	1	3	19	2	6	1	2								

JEE-ADVANCED QUESTIONS

Que.	1	2	3
Ans.	7	4	119