



CTQ - 2023

CTQ : Concept Through Questions

Year : 2023

Topic : Sets and Relation

1. Let R_1 be a relation defined by
 $R_1 = \{(a, b) | a \geq b, a, b \in R\}$. Then, R_1 is
 - a) An equivalence relation on R
 - b) Reflexive, transitive but not symmetric
 - c) Symmetric, transitive but not reflexive
 - d) Neither transitive nor reflexive but symmetric
2. On the set of human beings a relation R is defined as follows:
"aRb iff a and b have the same brother". Then R is
 - a) Only reflexive
 - b) Only symmetric
 - c) Only transitive
 - d) Equivalence
3. In a class of 35 students, 17 have taken Mathematics, 10 have taken Mathematics but not Economics. If each student has taken either Mathematics or Economics or both, then the number of students who have taken Economics but not Mathematics is
 - a) 7
 - b) 25
 - c) 18
 - d) 32
4. $\{n(n+1)(2n+1) : n \in Z\} \subset$
 - a) $\{6k : k \in Z\}$
 - b) $\{12k : k \in Z\}$
 - c) $\{18k : k \in Z\}$
 - d) $\{24k : k \in Z\}$
5. If $A = \{1, 2, 3, 4, 5\}$, $B = \{2, 4, 6\}$, $C = \{3, 4, 6\}$, then $(A \cup B) \cap C$ is
 - a) $\{3, 4, 6\}$
 - b) $\{1, 2, 3\}$
 - c) $\{1, 4, 3\}$
 - d) None of these
6. Let A be the set of all students in a school. A relation R is defined on A as follows:
"aRb iff a and b have the same teacher"
 - a) Reflexive
 - b) Symmetric
 - c) Transitive
 - d) Equivalence
7. If P is the set of all parallelograms, and T is the set of all trapeziums, then $P \cap T$ is
 - a) P
 - b) T
 - c) \emptyset
 - d) None of these
8. A and B are any two non-empty sets and A is proper subset of B . If $n(A) = 5$, then find the minimum possible value of $n(A \Delta B)$
 - a) is 1
 - b) is 5
 - c) Cannot be determined
 - d) None of these
9. If $n(A) = 4$, $n(B) = 3$, $n(A \times B \times C) = 240$, then $n(C)$ is equal to
 - a) 288
 - b) 1
 - c) 12
 - d) 2
10. In a class, 70 students wrote two tests viz; test-I and test-II. 50% of the students failed in test-I and 40% of the students in test-II. How many students passed in both tests?
 - a) 21
 - b) 7
 - c) 28
 - d) 14
11. Let Z denote the set of all integers and $A = \{(a, b) : a^2 + 3b^2 = 28, a, b \in Z\}$ and $B = \{(a, b) : a > b, a, b \in Z\}$. Then, the number of elements in $A \cap B$ is



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- a) 2 b) 3 c) 4 d) 6
12. 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 iff l_1 is parallel to l_2 . Then, the relation R is not
a) Reflexive b) Symmetric c) Transitive d) None of these
13. Let R be a relation on the set N be defined by $\{(x, y) | x, y \in N, 2x + y = 41\}$. Then, R is
a) Reflexive b) Symmetric c) Transitive d) None of these
14. In an office, every employee likes at least one of tea, coffee and milk. The number of employees who like only tea, only coffee, only milk and all the three are all equal. The number of employees who like only tea and coffee, only coffee and milk and only tea and milk are equal and each is equal to the number of employees who like all the three. Then a possible value of the number of employees in the office is
a) 65 b) 90 c) 77 d) 85
15. Which of the following cannot be the number of elements in the power set of any finite set?
a) 26 b) 32 c) 8 d) 16
16. The relation 'is subset of' on the power set $P(A)$ of a set A is
a) Symmetric b) Anti-symmetric c) Equivalence relation d) None of these
17. Let A and B be two non-empty subsets of a set X such that A is not a subset of B . Then,
a) A is a subset of complement of B
b) B is a subset of A
c) A and B are disjoint
d) A and the complement of B are non-disjoint
18. If A, B and C are three sets such that $A \supset B \supset C$, then $(A \cup B \cup C) - (A \cap B \cap C) =$
a) $A - B$ b) $B - C$ c) $A - C$ d) None of these
19. A survey shows that 63% of the Americans like cheese whereas 76% like apples. If $x\%$ of the Americans like both cheese and apples, then
a) $x = 39$ b) $x = 63$ c) $39 \leq x \leq 63$ d) None of these
20. If $X = \{4^n - 3n - 1 : n \in N\}$ and $Y = \{9(n-1) : n \in N\}$, then $X \cup Y$ is equal to
a) X b) Y c) N d) None of these
21. Let $A = \{x : x \text{ is a multiple of } 3\}$ and $B = \{x : x \text{ is a multiple of } 5\}$. Then, $A \cap B$ is given by
a) $\{3, 6, 9, \dots\}$ b) $\{5, 10, 15, 20, \dots\}$ c) $\{15, 30, 45, \dots\}$ d) None of these
22. If $n(A \times B) = 45$, then $n(A)$ cannot be
a) 15 b) 17 c) 5 d) 9
23. In order that a relation R defined on a non-empty set A is an equivalence relation, it is sufficient, if R
a) Is reflective
b) Is symmetric
c) Is transitive
d) Possesses all the above three properties
24. 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
a) Reflexive b) Symmetric c) Transitive d) None of these
25. In a class of 45 students, 22 can speak Hindi and 12 can speak English only. The number of students, who can speak both Hindi and English, is
a) 9 b) 11 c) 23 d) 17
26. A, B and C are three non-empty sets. If $A \subset B$ and $B \subset C$, then which of the following is true?



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- a) $B - A = C - B$ b) $A \cap B \cap C = B$ c) $A \cup B = B \cap C$ d) $A \cup B \cup C = A$
27. $\left\{x \in R : \frac{2x-1}{x^3+4x^2+3x} \in R\right\}$ equals
a) $R - \{0\}$ b) $R - \{0, 1, 3\}$ c) $R - \{0, -1, -3\}$ d) $R - \left\{0, -1, -3, +\frac{1}{2}\right\}$
28. 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
a) 2^{mn} b) $2^{mn} - 1$ c) $2mn$ d) m^n
29. If $A = \{(x, y) : y^2 = x; x, y \in R\}$ and $B = \{(x, y) : y = |x|; x, y \in R\}$, then
a) $A \cap B = \emptyset$
b) $A \cap B$ is a singleton set
c) $A \cap B$ contains two elements only
d) $A \cap B$ contains three elements only
30. Which of the following is an equivalence relation?
a) Is father of b) Is less than c) Is congruent to d) Is an uncle of
31. From 50 students taking examinations in Mathematics, Physics and Chemistry, 37 passed Mathematics, 24 Physics and 43 Chemistry. At most 19 passed Mathematics and Physics, at most 29 passed Mathematics and Chemistry and at most 20 passed Physics and Chemistry. The largest possible number that could have passed all three examinations is
a) 11 b) 12 c) 13 d) 14
32. Let A be the non-void set of the children in a family. The relation ' x is a brother of y ' on A is
a) Reflexive b) Symmetric c) Transitive d) None of these
33. In a class of 30 pupils 12 take needle work, 16 take physics and 18 take history. If all the 30 students take at least one subject and no one takes all three, then the number of pupils taking 2 subjects is
a) 16 b) 6 c) 8 d) 20
34. If R is a relation on a finite set having n elements, then the number of relations on A is
a) 2^n b) 2^{n^2} c) n^2 d) n^n
35. The void relation on a set A is
a) Reflexive
b) Symmetric and transitive
c) Reflexive and symmetric
d) Reflexive and transitive
36. Suppose A_1, A_2, \dots, A_{30} are thirty sets, each having 5 elements and B_1, B_2, \dots, B_n are n sets each with 3 elements, let $\bigcup_{i=1}^{30} A_i = \bigcup_{j=1}^n B_j = S$ and each element of S belongs to exactly 10 of the A_i 's and exactly 9 of the B_j 's. Then, n is equal to
a) 115 b) 83 c) 45 d) None of these
37. If A is a finite set having n elements, then $P(A)$ has
a) $2n$ elements b) 2^n elements c) n elements d) None of these
38. Let A and B have 3 and 6 elements respectively. What can be the minimum number of elements in $A \cup B$?



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- a) 3 b) 6 c) 9 d) 18
39. Let R be a reflexive relation on a set A and I be the identity relation on A . Then,
a) $R \subset I$ b) $I \subset R$ c) $R = I$ d) None of these
40. If A_1, A_2, \dots, A_{100} are sets such that $n(A_i) = i + 2, A_1 \subset A_2 \subset A_3 \dots \subset A_{100}$ and $\bigcap_{i=3}^{100} A_i = A$, then $n(A) =$
a) 3 b) 4 c) 5 d) 6
41. If A and B are two given sets, then $A \cap (A \cap B)^c$ is equal to
a) A b) B c) \emptyset d) $A \cap B^c$
42. If a set has 13 elements and R is a reflexive relation on A with n elements, then
a) $13 \leq n \leq 26$ b) $0 \leq n \leq 26$ c) $13 \leq n \leq 169$ d) $0 \leq n \leq 169$
43. Let X be the set of all engineering colleges in a state of Indian Republic and R be a relation on X defined as two colleges are related iff they are affiliated to the same university, then R is
a) Only reflexive b) Only symmetric c) Only transitive d) Equivalence
44. In the above question, the number of families which buy none of A, B and C is
a) 4000 b) 3300 c) 4200 d) 5000
45. If A and B are two sets, then $A \cap (A \cup B)$ equals
a) A b) B c) \emptyset d) None of these
46. If $A = \{1, 3, 5, 7, 9, 11, 13, 15, 17\}, B = \{2, 4, \dots, 18\}$ and N is the universal set, then $A' \cup ((A \cup B) \cap B')$ is
a) A b) N c) B d) none of these
47. If $A = \{\emptyset, \{\emptyset\}\}$, then the power set of A is
a) A b) $\{\emptyset, \{\emptyset\}, A\}$ c) $\{\emptyset, \{\emptyset\}, \{\{\emptyset\}\}, A\}$ d) None of these
48. Let $A = \{(x, y) : y = e^x, x \in R\}, B = \{(x, y) : y = e^{-x}, x \in R\}$. Then,
a) $A \cap B = \emptyset$ b) $A \cap B \neq \emptyset$ c) $A \cup B = R^2$ d) None of these
49. 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
a) Reflexive b) Symmetric c) Transitive d) None of these
50. If A, B and C are three sets such that $A \cap B = A \cap C$ and $A \cup B = A \cup C$, then
a) $A = C$ b) $B = C$ c) $A \cap B = \emptyset$ d) $A = B$



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Answer Key

Ques.	1	2	3	4	5	6	7	8	9	10
Ans.	B	D	C	A	A	D	A	A	D	B
Ques.	11	12	13	14	15	16	17	18	19	20
Ans.	D	D	D	C	A	B	D	C	C	B
Ques.	21	22	23	24	25	26	27	28	29	30
Ans.	C	B	D	A	B	C	C	A	D	C
Ques.	31	32	33	34	35	36	37	38	39	40
Ans.	D	C	A	B	B	C	B	B	B	C
Ques.	41	42	43	44	45	46	47	48	49	50
Ans.	D	C	D	A	A	B	C	B	B	B