[20]

*** Choose the right answer from the given options. [1 Marks Each]**

1. In a class 60% of the students were boys and 30% of them had I class. If 50% of the students in the class had I class, find the fraction of the girls in the class who did not have a I class:

   (A) $\frac{1}{5}$ (B) $\frac{4}{5}$ (C) $\frac{1}{4}$ (D) $\frac{1}{3}$

   Ans. :

   a. $\frac{1}{5}$

2. Choose the correct answers from the given four option:
   Two finite sets have m and n elements. The number of subsets of the first set is 112 more than that of the second set. The values of m and n are, respectively,

   (A) 4, 7 (B) 7, 4 (C) 4, 4 (D) 7, 7

   Ans. :

   b. 7, 4

   Solution:

   According to the question,

   $\Rightarrow 2^m - 2^n = 12$

   $\Rightarrow 2^n(2^{m-n} - 1)\ 2^4.\ 7$

   $\Rightarrow 2n = 2^4$ and $2^{m-n} - 1 = 7$

   $\Rightarrow n = 2$ and $2^{m-n} = 8$

   $\Rightarrow 2^{m-n} = 2^3 \Rightarrow m - n = 3 \Rightarrow m - 4 = 3 \Rightarrow m = 7$

3. Choose the correct answers from the given four option:
   The set $(A \cap B')' \cup (B \cap C)$ is equal to.

   (A) $A' \cup B \cup C$ (B) $A' \cup B$ (C) $A' \cup C'$ (D) $A' \cap B$

   Ans. :

   b. $A' \cup B$

   Solution:

   We konw that: $(A \cap B)' = A' \cup B'$ [De Morgan's law]

   $\therefore (A \cap B')' \cup (B \cap C) = [A' \cup (B')] \cup (B \cap C)$

   $= (A' \cap B) \cup (B \cap C) [\because (B')' = B]$

   $= A' \cup B$

   Hence, the correct optiom is (b).

4. If A = {1, 2, 3, 4}, what is the number of subsets of A with at least three elements?

   (A) 3 (B) 4 (C) 5 (D) 10

   Ans. :

   c. 5

   Solution:

   A subset containing 3 elements = {1, 2, 3};{1, 3, 4};{1, 2, 4} and {2, 3, 4}

   A subset containing 4 elements ={1, 2, 3, 4}

   $\therefore$ there are five subsets containing at least 3 elements.

5. If A and B are two sets such that n(A) = 17, n(B) = 23, n(A ∪ B) = 38, find n(A ∩ B):

   (A) 1 (B) 2 (C) 3 (D) 4

   Ans. :

   b. 2

   Solution:

   We know,

   n(A ∩ B) = n(A) + n(B) - n(A ∪ B)

   n(A ∩ B) = 17 + 23 - 38 = 2

6. Choose the correct answers from the given four option:
   In a town of 840 persons, 450 persons read Hindi, 300 read English and 200 read both. Then the number of persons who read neither is,

   (A) 210 (B) 290 (C) 180 (D) 260

   Ans. :

b. 290

Solution:

Let H be the set of persons who read Hindi and E be the ser of persons who read English.

Then, n(U) = 840, n(H) = 450, n(E) 300, $n(H \cap E) = 200$

Number of persons who read neither $= n(H' \cap F')$

$= n(H \cup E)' = n(U) - n(H \cup E)$

$= 840 - [n(H) + n(E) - n(H \cap E)]$

$= 840 - (450 + 300 - 200) = 290$

7. If A and B are finite sets, then which one of the following is the correct equation?

(A) n (A - B) = n (A) - n (B) (B) n (A - B) = n (B - A) (C) n (A - B) = n (A) - n $(A \cup B)$ (D) n (A - B) = n (B) - n $(A \cap B)$

Ans. :

d. n (A - B) = n (A) - n $(A \cup B)$

8. Let A and B be two sets such that n(A) = 16, n(B) = 12, and n(A ∩ B) = 8.Then n(A∪B) equals:

(A) 28 (B) 20 (C) 36 (D) 12

Ans. :

b. 20

Solution:

n(A ∪ B) = n(A) + n(B) − n(A ∩ B) = 16 + 12 − 8 = 20

9. Let n(A) = 28,n(A ∩ B) =8, n(A∪B) =52, then n(A ∩ B′):

(A) 30 (B) 32 (C) 20 (D) none of these

Ans. :

c. 20

Solution:

Given n(A) = 28, n(A ∩ B) = 8.

We have A ∩ B′ = A - A ∩ B.

This give n(A ∩ B′) = n(A) -n(A ∩ B)

or, n(A ∩ B′) = 28 - 8 = 20.

10. The solution set of 3x − 4 < 8 over the set of non-negative square numbers is:

(A) {1, 2, 3} (B) {1,4} (C) {1} (D) {16}

Ans. :

c. {1}

Solution:

3x − 4 < 8

3x < 12

x < 4

Hence set of non-negative square numbers belonging to the above set is {1}.

11. In a class of 175 students the following data shows the number of students opting one or more subjects. Mathematics 100; Physics 70; Chemistry 40; Mathematics and Physics 30; Mathematics and Chemistry 28; Physics and Chemistry 23; Mathematics, Physics and Chemistry 18. How many students have offered Mathematics alone?

(A) 35 (B) 48 (C) 60 (D) 22.

Ans. :

c. 60.

Solution:

Let M, P and C denote the sets of students who have opted for mathematics, physics, and chemistry, respectively.

Here,

$n(M) = 100,\ n(P) = 70,\ n(C) = 40$

Now,

$n(M \cap P) = 30, n(M \cap C) = 28,$

$n(P \cap C) = 23, n(M \cap P \cap C) = 18$

Number of students who opted for only mathematics:

$n(M \cap P' \cap C)' = \{M \cap (P \cap C)'\}$

$= n(M) - n\{M \cap (P \cap C)\}$

$= n(M) - n\{(M \cap P) \cup (M \cap C)\}$

$= n(M) - \{n(M \cap P) + n(M \cap C) - n(M \cap P \cap C\}$

$= 100 - (30 + 28 - 18)$

$= 60$

$\therefore$ the number of students who opted for mathematics alone is 60.

12. Consider the following equations:
    i. $A - B = A - (A \cap B)$
    ii. $A = (A \cap B) \cup (A - B)$
    iii. $A - (B \cup C) = (A - B) \cup (A - C)$

    Which of these is/are correct?

    (A) 1 and 3 (B) 2 only (C) 2 and 3 (D) 1 and 2

    Ans. :

    d. 1 and 2

13. Which one is different from the others?
    i. Empty
    ii. Void
    iii. Zero
    iv. Null

    (A) (i) (B) (ii) (C) (iii) (D) (iv)

    Ans. :

    d. (iv)

14. Which of the following properties are associative law?

    (A) $A \cup B = B \cup A$ (B) $A \cup C = C \cup A$

    (C) $A \cup D = D \cup A$ (D) $(A \cup B) \cup C = A \cup (B \cup C)$

    Ans. :

    d. $(A \cup B) \cup C = A \cup (B \cup C)$

15. The set of all those elements of A and B which are common to both is called:

    (A) Union of two sets (B) Intersection of two sets

    (C) Disjoint sets (D) None of these

    Ans. :

    b. Intersection of two sets

    Solution:

    The set of all those elements of A and B which are common to both is called A intersection B = A ∩ B.

16. Choose the correct answers from the given four option:

    If X and Y are two sets and X′ denotes the complement of X, then $X \cap (X \cup Y)'$ is equal to.

    (A) X. (B) Y. (C) ϕ. (D) $X \cap Y$.

    Ans. :

    b. ϕ.

    Solution:

    Let $x \in X \cap (X \cup Y)'$

    $\Rightarrow x \in X \cap (X' \cup Y)'$

    $\Rightarrow x \in (X \cap X) \cap (X \cap Y')$

    $\Rightarrow x \in \phi \cap (x \cap Y') \left[\because A \cap A' = \phi \right]$

    $\Rightarrow x \in \phi$

    Hence, the correct option is (c).

17. In a class of 80 children, 35% children can play only cricket, 45% children can play only table-tennis and the remaining children can play both the games. In all, how many children can play cricket?

    (A) 55 (B) 44 (C) 36 (D) 28

    Ans. :

    b. 44

    Solution:

    Clearly 35% children can play cricket. Also 20% can play both.

    So 55% children can play cricket

    Total no. of kids = 0.55 × 80 = 44

18. The number of subsets of a set containing n elements is:

    (A) n (B) $2^n - 1$ (C) n^2 (D) 2^n.

    Ans. :

    d. 2^n.

Solution:

The total number of subsets of a finite set consisting of n elements is 2^n.

19. Out of 800 boys in a school 224 played cricket, 240 played hockey and 236 played basketball. Of the total 64 played both basketball and hockey, 80 played cricket and basketball and 40 played cricket and hockey, 24 players all the three games. The number of boys who did not play any game is:

(A) 128 (B) 216 (C) 240 (D) 260

Ans. :

d. 260

Solution:

No. of players who played at least one game is:

By set theory

n(C ∪ H ∪ B) = n(C) + n(H) + n(B) − n(B ∩ H) − n(C ∩ B) − n(C ∩ H) + n(C ∩ H ∩ B)

= 224 + 240 + 236 − 64 − 80 − 40 + 24 = 540

20. For any three sets A, B and C:

(A) $\mathrm{A} \cap (\mathrm{B} - \mathrm{C}) = (\mathrm{A} \cap \mathrm{B}) - (\mathrm{A} \cap \mathrm{C})$

(B) $\mathrm{A} \cap (\mathrm{B} - \mathrm{C}) = (\mathrm{A} \cap \mathrm{B}) - \mathrm{C}$

(C) $\mathrm{A} \cup (\mathrm{B} - \mathrm{C}) = (\mathrm{A} \cup \mathrm{B}) \cap (\mathrm{A} \cup \mathrm{C}')$

(D) $\mathrm{A} \cup (\mathrm{B} - \mathrm{C}) = (\mathrm{A} \cup \mathrm{B}) - (\mathrm{A} \cup \mathrm{C})$.

Ans. :

a. $\mathrm{A} \cap (\mathrm{B} - \mathrm{C}) = (\mathrm{A} \cap \mathrm{B}) - (\mathrm{A} \cap \mathrm{C})$

b. $\mathrm{A} \cap (\mathrm{B} - \mathrm{C}) = (\mathrm{A} \cap \mathrm{B}) - \mathrm{C}$

c. $\mathrm{A} \cup (\mathrm{B} - \mathrm{C}) = (\mathrm{A} \cup \mathrm{B}) \cap (\mathrm{A} \cup \mathrm{C}')$.

Solution:

Let x be any arbitrary element of $\mathrm{A} \cap \mathrm{B} - \mathrm{C}$.

Thus, we have,

$\mathrm{x} \in \mathrm{A} \cap (\mathrm{B} - \mathrm{C}) \Rightarrow \mathrm{x} \in \mathrm{A}$ and $\mathrm{x} \in \mathrm{B} - \mathrm{C}$

$\Rightarrow \mathrm{x} \in \mathrm{A}$ and $(\mathrm{x} \in \mathrm{B} \text{ and } \mathrm{x} \notin \mathrm{C})$

$\Rightarrow \mathrm{x} \in \mathrm{A} \text{ and } \mathrm{x} \in \mathrm{B}$ and $\Rightarrow \mathrm{X} \in \mathrm{A} \text{ and } \mathrm{x} \notin \mathrm{C}$

$\Rightarrow \mathrm{x}(\mathrm{A} \cap \mathrm{B})$ and $\mathrm{x} \notin (\mathrm{A} \cap \mathrm{C})$

$\Rightarrow \mathrm{x} \in [(\mathrm{A} \cap \mathrm{B}) - (\mathrm{A} \cap \mathrm{C})]$

$\Rightarrow \mathrm{A} \cap (\mathrm{B} - \mathrm{C}) \subseteq (\mathrm{A} \cap \mathrm{B}) - (\mathrm{A} \cap \mathrm{C})$

Similarly, $(\mathrm{A} \cap \mathrm{B}) - (\mathrm{A} - \mathrm{C}) \subseteq (\mathrm{A} \cap (\mathrm{B} - \mathrm{C})$

Hence, $\mathrm{A} \cap (\mathrm{B} - \mathrm{C}) = (\mathrm{A} \cap \mathrm{B}) - (\mathrm{A} \cap \mathrm{C})$.

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