CHAPTER

1

SETS

CONCEPT TYPE QUESTIONS

Directions : This section contains multiple choice questions. Each question has four choices (a), (b), (c) and (d), out of which only one is correct.

1. The set of intelligent students in a class is :
(a) a null set (b) a singleton set
(c) a finite set (d) not a well defined collection

2. If the sets A and B are given by A = {1, 2, 3, 4}, B = {2, 4, 6, 8, 10} and the universal set U = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}, then
(a) $(A \cup B)' = \{5, 7, 9\}$
(b) $(A \cap B)' = \{1, 3, 5, 6, 7\}$
(c) $(A \cap B)' = \{1, 3, 5, 6, 7, 8\}$
(d) None of these

3. If A = {1, 2, 3, 4}, B = {2, 3, 5, 6} and C = {3, 4, 6, 7}, then
(a) $A - (B \cap C) = \{1, 3, 4\}$
(b) $A - (B \cap C) = \{1, 2, 4\}$
(c) $A - (B \cup C) = \{2, 3\}$
(d) $A - (B \cup C) = \{\phi\}$

4. Which of the following is correct?
(a) $A \grave{E} B \supseteq A \grave{E} A'$
(b) $(A \check{C} B)' = A' \grave{E} B'$
(c) $(A' \grave{E} B') \supseteq A' \grave{E} A$
(d) $(A \check{C} B)' = A' \check{C} B'$

5. The number of the proper subset of {a, b, c} is:
(a) 3 (b) 8
(c) 6 (d) 7

6. Which one is different from the others ?
(i) empty set (ii) void set (iii) zero set (iv) null set :
(a) (i) (b) (ii)
(c) (iii) (d) (iv)

7. If the sets A and B are as follows :
$A = \{1, 2, 3, 4\}, B = \{3, 4, 5, 6\}$, then
(a) $A - B = \{1, 2\}$
(b) $B - A = \{5\}$
(c) $[(A - B) - (B - A)] \cap A = \{1, 2\}$
(d) $[(A - B) - (B - A)] \cup A = \{3, 4\}$

8. If A = {x, y} then the power set of A is :
(a) $\{x^x, y^y\}$ (b) $\{\phi, x, y\}$
(c) $\{\phi, \{x\}, \{2y\}\}$ (d) $\{\phi, \{x\}, \{y\}, \{x, y\}\}$

9. The set {x : x is an even prime number} can be written as
(a) {2} (b) {2, 4}
(c) {2,14} (d) {2, 4, 14}

10. Given the sets
$A = \{1, 3, 5\}, B = \{2, 4, 6\}$ and $C = \{0, 2, 4, 6, 8\}$. Which of the following may be considered as universal set for all the three sets A, B and C?
(a) {0, 1, 2, 3, 4, 5, 6}
(b) ϕ
(c) {0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10}
(d) {1, 2, 3, 4, 5, 6, 7, 8}

11. If $A \cup B \neq \phi$, then $n(A \cup B) = ?$
(a) $n(A) + n(B) - n(A \cap B)$
(b) $n(A) - n(B) + n(A \cap B)$
(c) $n(A) - n(B) - n(A \cap B)$
(d) $n(A) + n(B) + n(A \cap B)$

12. Which of the following collections are sets ?
(a) The collection of all the days of a week
(b) A collection of 11 best hockey player of India.
(c) The collection of all rich person of Delhi
(d) A collection of most dangerous animals of India.

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

14. Let $V = \{a, e, i, o, u\}$ and $B = \{a, i, k, u\}$. Value of $V - B$ and $B - V$ are respectively
(a) $\{e, o\}$ and $\{k\}$ (b) $\{e\}$ and $\{k\}$
(c) $\{o\}$ and $\{k\}$ (d) $\{e, o\}$ and $\{k, i\}$

15. Let $A = \{a, b\}, B = \{a, b, c\}$. What is $A \cup B$?
(a) $\{a, b\}$ (b) $\{a, c\}$
(c) $\{a, b, c\}$ (d) $\{b, c\}$

16. 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) $n(A-B) = n(A) - n(A \cap B)$
(d) $n(A-B) = n(B) - n(A \cap B)$
[n (A) denotes the number of elements in A]

17. If ϕ denotes the empty set, then which one of the following is correct ?
(a) $\phi \in \phi$ (b) $\phi \in \{\phi\}$
(c) $\{\phi\} \in \{\phi\}$ (d) $0 \in \phi$

18. Which one of the following is an infinite set ?
(a) The set of human beings on the earth
(b) The set of water drops in a glass of water
(c) The set of trees in a forest
(d) The set of all primes

19. Let A = {x : x is a multiple of 3} and B = { x : x is a multiple of 5}. Then $A \cap B$ is given by:
(a) {15, 30, 45,...}
(b) {3, 6, 9,...}
(c) {15, 10, 15, 20...}
(d) {5, 10, 20,...}

20. The set $A = \{x : x \in R, x^2 = 16 \text{ and } 2x = 6\}$ equals
(a) ϕ (b) {14, 3, 4}
(c) {3} (d) {4}

21. $A = \{x : x \neq x\}$ represents
(a) {x} (b) {1}
(c) { } (d) {0}

22. Which of the following is a null set ?
(a) {0}
(b) $\{x : x > 0 \text{ or } x < 0\}$
(c) $\{x : x^2 = 4 \text{ or } x = 3\}$
(d) $\{x : x^2 + 1 = 0, x \in \mathbf{R}\}$

23. In a group of 52 persons, 16 drink tea but not coffee, while 33 drink tea. How many persons drink coffee but not tea ?
(a) 17 (b) 36
(c) 23 (d) 19

24. There are 600 student in a school. If 400 of them can speak Telugu, 300 can speak Hindi, then the number of students who can speak both Telugu and Hindi is:
(a) 100 (b) 200
(c) 300 (d) 400

25. In a group of 500 students, there are 475 students who can speak Hindi and 200 can speak Bengali. What is the number of students who can speak Hindi only ?
(a) 275 (b) 300
(c) 325 (d) 350

26. The set builder form of given set A = {3, 6, 9, 12} and B = {1, 4, 9, ..., 100} is
(a) $A = \{x : x = 3n, n \in N \text{ and } 1 \le n \le 5\}$, $B = \{x : x = n^2, n \in N \text{ and } 1 \le n \le 10\}$
(b) $A = \{x : x = 3n, n \in N \text{ and } 1 \le n \le 4\}$, $B = \{x : x = n^2, n \in N \text{ and } 1 \le n \le 10\}$
(c) $A = \{x : x = 3n, n \in N \text{ and } 1 \le n \le 4\}$, $B = \{x : x = n^2, n \in N \text{ and } 1 < n < 10\}$
(d) None of these

27. Which of the following sets is a finite set?
(a) $A = \{x : x \in Z \text{ and } x^2 - 5x + 6 = 0\}$
(b) $B = \{x : x \in Z \text{ and } x^2 \text{ is even}\}$
(c) $D = \{x : x \in Z \text{ and } x > -10\}$
(d) All of these

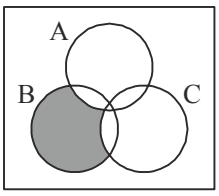
28. Which of the following is a singleton set?
(a) $\{x : |x| = 5, x \in N\}$
(b) $\{x : |x| = 6, x \in Z\}$
(c) $\{x : x^2 + 2x + 1 = 0, x \in N\}$
(d) $\{x : x^2 = 7, x \in N\}$

29. Which of the following is not a null set?
(a) Set of odd natural numbers divisible by 2
(b) Set of even prime numbers
(c) {x : x is a natural number, x < 5 and x > 7}
(d) {y : y is a point common to any two parallel lines}

30. If $A = \{x : x = n^2, n = 1, 2, 3\}$, then number of proper subsets is
(a) 3 (b) 8
(c) 7 (d) 4

31. Which of the following has only one subset?
(a) { } (b) {4}
(c) {4, 5} (d) {0}

32. The shaded region in the given figure is



(a) $B \cap (A \cup C)$ (b) $B \cup (A \cap C)$
(c) $B \cap (A - C)$ (d) $B - (A \cup C)$

33. If A = {x : x is a multiple of 3} and B = {x : x is a multiple of 5}, then A – B is equal to
(a) $\overline{A} \cap B$ (b) $A \cap \overline{B}$
(c) $\overline{A} \cap \overline{B}$ (d) $\overline{A \cap B}$

34. If A and B be any two sets, then $A \cap (A \cup B)'$ is equal to
(a) A (b) B
(c) ϕ (d) None of these

35. A survey shows that 63% of the people watch a news channel whereas 76% watch another channel. If x% of the people watch both channel, then
(a) x = 35 (b) x = 63
(c) $39 \le x \le 63$ (d) x = 39

36. The set $\left\{\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \frac{5}{6}, \frac{6}{7}\right\}$ in the set-builder form is

(a) $\left\{x : x = \frac{n}{n+1}, \text{ where } n \in N \text{ and } 1 < n < 6\right\}$

(b) $\left\{x : x = \frac{n}{n+1}, \text{ where } n \in N \text{ and } 1 \le n < 6\right\}$

(c) $\left\{x : x = \frac{n}{n+1}, \text{ where } n \in N \text{ and } 1 \le n \le 6\right\}$

(d) None of the above

37. The set {x : x is a positive integer less than 6 and $3^x - 1$ is an even number} in roster form is

(a) {1, 2, 3, 4, 5} (b) {1, 2, 3, 4, 5, 6}

(c) {2, 4, 6} (d) {1, 3, 5}

38. If B = {x : x is a student presently studying in both classes X and XI}. Then, the number of elements in set B are

(a) finite (b) infinite

(c) zero (d) None of these

39. Consider:

X = Set of all students in your school.

Y = Set of all students in your class.

Then, which of the following is true?

(a) Every element of Y is also an element of X

(b) Every element of X is also an element of Y

(c) Every element of Y is not an element of X

(d) Every element of X is not an element of Y

40. If $A \subset B$ and $A \neq B$, then

(a) A is called a proper subset of B

(b) A is called a super set of B

(c) A is not a subset of B

(d) B is a subset of A

41. The set of real numbers {x : a < x < b} is called

(a) open interval (b) closed interval

(c) semi-open interval (d) semi-closed interval

42. Which of the following is true?

(a) $a \in \{\{a\}, b\}$ (b) $\{b, c\} \subset \{a, \{b, c\}\}$

(c) $\{a, b\} \subset \{a, \{b, c\}\}$ (d) None of these

43. The interval [a, b) is represented on the number line as

(a) 

(b) 

(c) 

(d) 

44. The interval represented by

(a) (a, b) (b) [a, b]

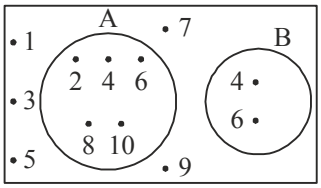
(c) [a, b) (d) (a, b]

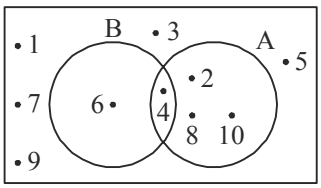
45. The number of elements in P[P(P(ϕ))] is

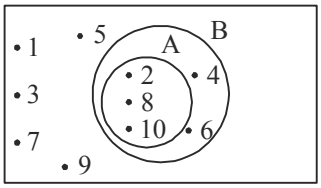
(a) 2 (b) 3

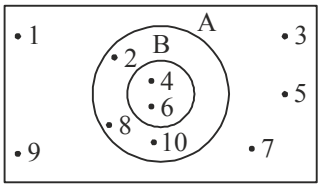
(c) 4 (d) 5

46. If U = {1, 2, 3, 4, ..., 10} is the universal set of A, B and A = {2, 4, 6, 8, 10}, B = {4, 6} are subsets of U, then given sets can be represented by Venn diagram as

(a) 

(b) 

(c) 

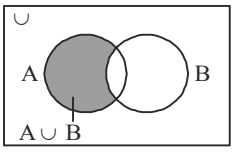
(d) 

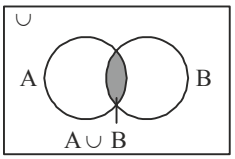
47. Most of the relationships between sets can be represented by means of diagrams which are known as

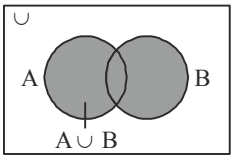
(a) rectangles (b) circles

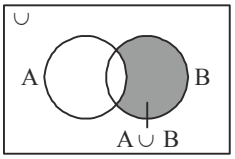
(c) Venn diagrams (d) triangles

48. Which of the following represent the union of two sets A and B?

(a) 

(b) 

(c) 

(d) 

49. Let X = {Ram, Geeta, Akbar} be the set of students of Class XI, who are in school hockey team and Y = {Geeta, David, Ashok} be the set of students from Class XI, who are in the school football team. Then, $X \cap Y$ is

(a) {Ram, Geeta} (b) {Ram}

(c) {Geeta} (d) None of these

50. Which of the following represent A – B?

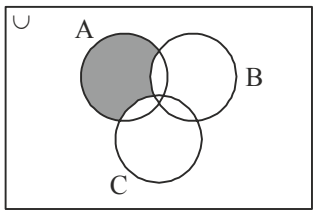
(a) $\{x : x \in A \text{ and } x \in B\}$

(b) $\{x : x \in A \text{ and } x \notin B\}$

(c) $\{x : x \in A \text{ or } x \in B\}$

(d) $\{x : x \in A \text{ or } x \notin B\}$

51. The shaded region in the given figure is

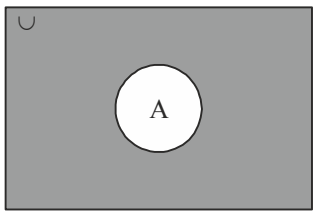


(a) $A \cap (B \cup C)$ (b) $A \cup (B \cap C)$
(c) $A \cap (B - C)$ (d) $A - (B \cup C)$

52. If A and B are non-empty subsets of a set, then $(A - B) \cup (B - A)$ equals to
(a) $(A \cap B) \cup (A \cup B)$ (b) $(A \cup B) - (A - B)$
(c) $(A \cup B) - (A \cap B)$ (d) $(A \cup B) - B$

53. Let A, B, C are three non-empty sets. If $A \subset B$ and $B \subset C$, then which of the following is true?
(a) $B - A = C - B$ (b) $A \cap B \cap C = B$
(c) $A \cup B = B \cap C$ (d) $A \cup B \cup C = A$

54. In the Venn diagram, the shaded portion represents



(a) complement of set A (b) universal set
(c) set A (d) None of these

55. If $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$, $A = \{1, 2, 3, 5\}$, $B = \{2, 4, 6, 7\}$ and $C = \{2, 3, 4, 8\}$, then which of the following is true?

(a) $(B \cup C)' = \{1, 5, 9, 10\}$

(b) $(C - A)' = \{1, 2, 3, 5, 6, 7, 9, 10\}$

(c) Both (a) and (b)
(d) None of the above

56. If A and B are two given sets, then $A \cap (A \cap B)^c$ is equal to
(a) A (b) B
(c) ϕ (d) $A \cap B^c$

57. If A and B are any two sets, then $A \cup (A \cap B)$ is equal to
(a) A (b) B
(c) A^c (d) B^c

58. The smallest set A such that $A \cup \{1, 2\} = \{1, 2, 3, 5, 9\}$ is
(a) $\{2, 3, 5\}$ (b) $\{3, 5, 9\}$
(c) $\{1, 2, 5, 9\}$ (d) None of these

59. If A and B are two sets, then $A \cap (A \cup B)'$ is equal to
(a) A (b) B
(c) ϕ (d) None of these

60. If A and B are sets, then $A \cap (B - A)$ is
(a) ϕ (b) A
(c) B (d) None of these

61. If $A = \{1, 2, 4\}$, $B = \{2, 4, 5\}$, $C = \{2, 5\}$, then $(A - B) \times (B - C)$ is
(a) $\{(1, 2), (1, 5), (2, 5)\}$ (b) $\{(1, 4)\}$
(c) $(1, 4)$ (d) None of these

62. If $n(A) = 3$, $n(B) = 6$ and $A \subseteq B$. Then, the number of elements in $A \cup B$ is equal to
(a) 3 (b) 9
(c) 6 (d) None of these

63. 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
(a) 10 (b) 12
(c) 15 (d) None of these

64. If $A = \{x : x \text{ is a multiple of } 4\}$ and $B = \{x : x \text{ is a multiple of } 6\}$, then $A \cap B$ consists of all multiples of
(a) 16 (b) 12
(c) 8 (d) 4

STATEMENT TYPE QUESTIONS

Directions : Read the following statements and choose the correct option from the given below four options.

65. Let P be a set of squares, Q be set of parallelograms, R be a set of quadrilaterals and S be a set of rectangles. Consider the following :

I. $P \subset Q$ II. $R \subset P$
III. $P \subset S$ IV. $S \subset R$

Which of the above are correct?
(a) I, II and III (b) I, III and IV
(c) I, II and IV (d) III and IV

66. Consider the following statements

I. $\phi \in \{\phi\}$ II. $\{\phi\} \subseteq \phi$

Which of the statements given above is/are correct?
(a) Only I (b) Only II
(c) Both I and II (d) Neither I nor II

67. Consider the following sets.
I. $A = \{1, 2, 3\}$
II. $B = \{x \in R : x^2 - 2x + 1 = 0\}$
III. $C = \{1, 2, 2, 3\}$
IV. $D = \{x \in R : x^3 - 6x^2 + 11x - 6 = 0\}$
Which of the following are equal?
(a) A = B = C (b) A = C = D
(c) A = B = D (d) B = C = D

68. Consider the following relations:
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) Both I and III (b) Only II
(c) Both II and III (d) Both I and II

69. Consider the following statements
I. The vowels in the English alphabet.
II. The collection of books.
III. The rivers of India.
IV. The collection of most talented batsmen of India.
Which of the following is/are well-defined collections?
(a) I and II (b) Only I
(c) I and III (d) I and IV

70. The set of all letters of the word 'SCHOOL' is represented by
I. {S, C, H, O, O, L}
II. {S, C, H, O, L}
III. {C, H, L, O, S}
IV. {S, C, H, L}
The correct code is
(a) I and II (b) I, II and III
(c) II and III (d) I, II, III and IV

71. I. The collection of all months of a year beginning with the letter J.
II. The collection of ten most talented writers of India.
III. A team of eleven best cricket batsmen of the world.
IV. The collection of all boys in your class.
Which of the above are the sets?
(a) I and II (b) I and III
(c) I and IV (d) I, II and III

72. **Statement - I :** The set D = {x : x is a prime number which is a divisor of 60} in roster form is {1, 2, 3, 4, 5}.
Statement - II : The set E = the set of all letters in the word 'TRIGONOMETRY', in the roster form is {T, R, I, G, O, N, M, E, Y}.
(a) Statement I is true (b) Statement II is true
(c) Both are true (d) Both are false

73. The empty set is represented by
I. ϕ II. $\{\phi\}$
III. { } IV. {{ }}
(a) I and II (b) I and III
(c) II and III (d) I and IV

74. **Statement - I :** The set $\{x : x \text{ is a real number and } x^2 - 1 = 0\}$ is the empty set.
Statement - II : The set $A = \{x : x \in R, x^2 = 16 \text{ and } 2x = 6\}$ is an empty set.
(a) Statement I is true (b) Statement II is true
(c) Both are true (d) Both are false

75. State which of the following is/are true?
I. The set of animals living on the Earth is finite.
II. The set of circles passing through the origin (0, 0) is infinite.
(a) Only I (b) Only II
(c) I and II (d) None of these

76. **Statement - I :** The set of positive integers greater than 100 is infinite.
Statement - II : The set of prime numbers less than 99 is finite.
(a) Statement I is true (b) Statement II is true
(c) Both are true (d) Both are false

77. Select the infinite set from the following:
I. The set of lines which are parallel to the X-axis.
II. The set of numbers which are multiples of 5.
III. The set of letters in the English alphabet.
(a) I and II (b) II and III
(c) I and III (d) None of these

78. Consider the following sets.
A = {0},
B = {x : x > 15 and x < 5},
C = {x : x – 5 = 0},
D = $\{x : x^2 = 25\}$,
E = {x : x is an integral positive root of the equation $x^2 - 2x - 15 = 0$}
Choose the pair of equal sets
(a) A and B (b) C and D
(c) C and E (d) B and C

79. **Statement - I :** The set of concentric circles in a plane is infinite.
Statement - II : The set $\{x : x^2 - 3 = 0 \text{ and } x \text{ is rational}\}$ is finite.
(a) Statement I is true (b) Statement II is true
(c) Both are true (d) Both are false

80. Which of the following is/are true?
I. Every set A is a subset of itself.
II. Empty set is a subset of every set.
(a) Only I is true (b) Only II is true
(c) Both I and II are true (d) None of these

81. Let A = {1, 3, 5} and B = {x : x is an odd natural number less than 6}. Then, which of the following are true?
I. $A \subset B$ II. $B \subset A$
III. $A = B$ IV. $A \not\in B$
(a) I and II are true (b) I and III are true
(c) I, II and III are true (d) I, II and IV are true

82. Given the sets A = {1, 3, 5}, B = {2, 4, 6} and C = {0, 2, 4, 6, 8}. Then, which of the following may be considered as universal set(s) for all the three sets A, B and C?
I. {0, 1, 2, 3, 4, 5, 6}
II. ϕ
III. {0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10}
IV. {1, 2, 3, 4, 5, 6, 7, 8}
(a) Only I (b) Only III
(c) I and III (d) III and IV

83. Which of the following is/are the universal set(s) for the set of isosceles triangles?
I. Set of right angled triangles.
II. Set of scalene triangles.
III. Set of all triangles in a plane.
(a) Only I (b) Only III
(c) II and III (d) None of these

84. **Statement - I :** In the union of two sets A and B, the common elements being taken only once.
Statement - II : The symbol '$\cap$' is used to denote the union.
(a) Statement I is true (b) Statement II is true
(c) Both are true (d) Both are false

85. **Statement - I :** Let A = {a, b} and B = {a, b, c}. Then, $A \not\subset B$.
Statement - II : If $A \subset B$, then $A \cup B = B$.
(a) Statement I is true (b) Statement II is true
(c) Both are true (d) Both are false

86. Which of the following are correct?
I. $A - B = A - (A \cap B)$.
II. $A = (A \cap B) \cup (A - B)$.
III. $A - (B \cup C) = (A - B) \cup (A - C)$.
(a) I and II (b) II and III
(c) I, II and III (d) None of these

87. Which of the following is/are true?
I. If A is a subset of the universal set U, then its complement A' is also a subset of U.
II. If U = {1, 2, 3, ..., 10} and A = {1, 3, 5, 7, 9}, then $(A')' = A$.
(a) Only I is true (b) Only II is true
(c) Both I and II are true (d) None of these

88. **Statement-I :** Let U be the universal set and A be the subset of U. Then, complement of A is the set of element of A.
Statement-II : The complement of a set A can be represented by A'.
(a) Statement I is true (b) Statement II is true
(c) Both are true (d) Both are false

89. **Statement-I :** The Venn diagram of $(A \cup B)'$ and $A' \cap B'$ are same.
Statement-II : The Venn diagram of $(A \cap B)'$ and $A' \cup B'$ are different.
(a) Statement I is true (b) Statement II is true
(c) Both are true (d) Both are false

90. **Statement-I :** If A, B and C are finite sets, then $n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap C) - n(A \cap C) + n(A \cap B \cap C)$.
Statement-II : If A, B and C are mutually pairwise disjoint, then $n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap C) - n(A \cap C)$.
(a) Statement I is true (b) Statement II is true
(c) Both are true (d) Both are false

91. In a survey of 400 students in a school, 100 were listed as taking apple juice, 150 as taking orange juice and 75 were listed as taking both apple as well as orange juice. Then, which of the following is/are true?
I. 150 students were taking at least one juice.
II. 225 students were taking neither apple juice nor orange juice.
(a) Only I is true (b) Only II is true
(c) Both I and II are true (d) None of these

92. Suppose A be a non-empty set, then the collection of all possible subsets of set A is a power set P(A).
Which of the following is correct?
I. $P(A) \cap P(B) = P(A \cap B)$
II. $P(A) \cup P(B) = P(A \cup B)$
(a) Only I is true (b) Only II is true
(c) Both I and II are true (d) Both I and II are false

93. Which of the following is correct?
I. Number of subsets of a set A having n elements is equal to 2^n.
II. The power set of a set A contains 128 elements then number of elements in set A is 7.
(a) Only I is true (b) Only II is true
(c) Both I and II are true (d) Both I and II are false

94. Which of the following is correct?
I. Number of non-empty subsets of a set having n elements are $2^n - 1$.
II. The number of non-empty subsets of the set {a, b, c, d} are 15.
(a) Only I is false (b) Only II is false
(c) Both I and II are false (d) Both I and II are true

95. **Statement-I** : If $A = \{1, 2, 3, 4, 5\}$, $B = \{2, 4, 6\}$, $C = \{3, 4, 6\}$, then $(A \cup B) \cap C = \{3, 4, 6\}$
Statement-II : $(A \cup B)' = A' \cap B'$
(a) Only I is true
(b) Only II is true
(c) Both I and II are true.
(d) Both I and II are false.

96. Let $A = \{3, 6, 9, 12, 15, 18, 21\}$
$B = \{4, 8, 12, 16, 20\}$
$C = \{2, 4, 6, 8, 10, 12, 14, 16\}$
and $D = \{5, 10, 15, 20\}$
Which of the following is incorrect?
I. $A - B = \{4, 8, 16, 20\}$
II. $(C - B) \cap (D - B) = \phi$
III. $B - C \neq B - D$
(a) Only I & II (b) Only II & III
(c) Only III & I (d) None of these

97. Which of the following is correct?
I. $n(S \cup T)$ is maximum when $n(S \cap T)$ is least.
II. If $n(U) = 1000, n(S) = 720, n(T) = 450$, then least value of $n(S \cap T) = 170$.
(a) Only I is true (b) Only II is true
(c) Both I and II are true (d) Both I and II are false

98. Which of the following is correct?
I. Three sets A, B, C are such that $A = B \cap C$ and $B = C \cap A$, then $A = B$.
II. If $A = \{a, b\}$, then $A \cap P(A) = A$
(a) Only I is true (b) Only II is true
(c) Both are true (d) Both are false

99. Consider the following relations :
I. $A = (A \cap B) \cup (A - B)$
II. $A - B = A - (A \cap B)$
III. $A - (B \cup C) = (A - B) \cup (A - C)$
Which of these is correct?
(a) I and III (b) I and II
(c) Only II (d) II and III

100. Consider the following statements.
I. If A_n is the set of first n prime numbers, then $\bigcup_{n=2}^{10} A_n$ is equal to $\{2, 3, 5, 7, 11, 13, 17, 19, 23, 29\}$
II. If A and B are two sets such that $n(A \cup B) = 50$, $n(A) = 28, n(B) = 32$, then $n(A \cap B) = 10$.
Which of these is correct?
(a) Only I is true (b) Only II is true
(c) Both are true (d) Both are false

101. Consider the following statements.
I. Let A and B be any two sets. The union of A and B is the set containing the elements of A and B both.
II. The intersection of two sets A and B is the set which consists of common elements of A and B.
Which of the statement is correct?
(a) Only statement-I is true.
(b) Only statement-II is true.
(c) Both statements are true.
(d) Neither I nor II are true.

MATCHING TYPE QUESTIONS

Directions : Match the terms given in column-I with the terms given in column-II and choose the correct option from the codes given below.

102. Match the following statements in column-I with their symbolic forms in column-II.

Column – I	Column – II
A. A is a subset of B	1. if and only if
B. If $A \subset B$ and $B \subset A$, then	2. $A \subset B$
C. A is not a subset of B	3. $A = B$
D. If $a \in A \Rightarrow a \in B$, then	4. $A \not\subset B$
E. The symbol "$\Leftrightarrow$" means	

Codes:

	A	B	C	D	E
(a)	4	3	1	2	3
(b)	2	3	4	2	1
(c)	1	2	3	4	3
(d)	4	3	2	1	4

103. Match the following sets in column -I with the intervals in column -II.

Column – I	Column – II
A. $\{x : x \in R, a < x < b\}$	1. $(a, b]$
B. $\{x \in R : a \le x \le b\}$	2. $[a, b)$
C. The set of real numbers x such that $a \le x < b$	3. (a, b)
D. $\{x : x \in R$ and $a < x \le b\}$	4. $[a, b]$

Codes:

	A	B	C	D
(a)	4	1	2	3
(b)	2	3	4	1
(c)	1	2	3	4
(d)	3	4	2	1

104. Match the following sets in column -I with the equal sets in column-II.

Column – I	Column – II
A. $A \cap B$	1. $(A \cap B) \cup (A \cap C)$
B. $(A \cap B) \cap C$	2. A
C. $\phi \cap A$	3. $A \cap (B \cap C)$
D. $U \cap A$	4. $B \cap A$
E. $A \cap A$	5. ϕ
F. $A \cap (B \cup C)$	

Codes:

	A	B	C	D	E	F
(a)	5	1	4	3	1	2
(b)	3	4	2	1	5	4
(c)	4	3	5	2	2	1
(d)	1	2	3	4	5	2

105. Match the following sets in column -I equal with the sets in column-II.

Column – I	Column – II
A. $A \cup A'$	1. $A' \cap B'$
B. $A \cap A'$	2. $A' \cup B'$
C. $(A \cup B)'$	3. U
D. $(A \cap B)'$	4. ϕ
E. ϕ'	5. A
F. U'	
G. $(A')'$	

Codes:

	A	B	C	D	E	F	G
(a)	1	2	3	4	5	3	2
(b)	3	4	1	2	3	4	5
(c)	4	3	2	1	4	5	3
(d)	5	4	3	2	1	4	1

106.

Column - I (Set)	**Column - II (Roster-form)**
(A) $\{x \in N : x^2 < 25\}$	1. $\{1, 2, 3, 4, 5\}$
(B) Set of integers between – 5 and 5	2. $\{2, 3, 5\}$
(C) $\{x : x$ is a natural number less than 6$\}$	3. $\{-4, -3, -2, -1, 0, 1, 2, 3, 4\}$
(D) $\{x : x$ is a prime number which is a divisor of 60$\}$	4. $\{1, 2, 3, 4\}$

Codes :

	A	B	C	D
(a)	4	2	1	3
(b)	1	3	4	2
(c)	1	2	3	4
(d)	4	3	1	2

107.

Column - I	**Column - II**
(A) If $A \cup B = A \cap B$, then	1. $A = B$
(B) Let A, B and C be the sets such that $A \cup B = A \cup C$ and $A \cap B = A \cap C$, then	2. $A \cup B$
(C) If $P(A) = P(B)$, then	3. $A \subset B$
(D) $A \cup (B - A)$ is equal to	4. $(A \cap B \cap C)'$
(E) Let U be the universal set and $A \cup B \cup C = U$. Then, $\{(A - B) \cup (B - C) \cup (C - A)\}$ is equal to	5. $B = C$
(F) The set $(A \cap B')' \cup (B \cup C)$ is equal to	6. $A' \cup B$

Codes :

	A	B	C	D	E	F
(a)	1	2	3	4	5	6
(b)	3	2	1	5	6	4
(c)	2	1	5	4	6	2
(d)	3	5	1	2	4	6

108. If $U = \{1, 2, 3, 4, 5, 6, 7\}$, $A = \{2, 4, 6\}$, $B = \{3, 5\}$ and $C = \{1, 2, 4, 7\}$, then match the columns.

Column-I	**Column-II**
(A) $A \cup (B \cap C)$	1. $\{1, 2, 4, 7\}$
(B) $(A \cap B) \cup C$	2. $\{6\}$
(C) $A \cap (B \cup C)'$	3. $\{1, 3, 5, 7\}$
(D) $A' \cup (B \cap C')$	4. $\{1, 7\}$
(E) $A' \cap B'$	5. $\{2, 4, 6\}$

Codes :

	A	B	C	D	E
(a)	1	5	3	2	4
(b)	5	1	2	3	4
(c)	5	1	3	4	2
(d)	3	4	5	1	2

109. Match the complement of sets of the following sets in column-I with the sets in column-II.

Column - I	**Column - II**
(A) $\{x: x$ is a prime number$\}$	1. $\{x : x$ is not divisible by 15$\}$
(B) $\{x : x$ is a multiple of 3$\}$	2. $\{x : x$ is an odd natural number$\}$
(C) $\{x : x$ is a natural number divisible by 3 and 5$\}$	3. $\{x : x$ is not a prime number$\}$
(D) $\{x : x$ is an even natural number$\}$	4. $\{x : x$ is not a multiple of 3$\}$

Codes :

	A	B	C	D
(a)	3	4	2	1
(b)	1	2	3	4
(c)	3	4	1	2
(d)	4	3	2	1

INTEGER TYPE QUESTIONS

Directions : This section contains integer type questions. The answer to each of the question is a single digit integer, ranging from 0 to 9. Choose the correct option.

110. If $X = \{1, 2, 3, \ldots, 10\}$ and 'a' represents any element of X, then the set containing all the elements satisfy $a + 2 = 6$, $a \in X$ is
(a) $\{4\}$ (b) $\{3\}$
(c) $\{2\}$ (d) $\{5\}$

111. If a set is denoted as $B = \phi$, then the number of element in B is
(a) 3 (b) 2
(c) 1 (d) 0

112. Let $X = \{1, 2, 3, 4, 5\}$. Then, the number of elements in X are
(a) 3 (b) 2
(c) 1 (d) 5

113. If $X = \{1, 2, 3\}$, then the number of proper subsets is
(a) 5 (b) 6
(c) 7 (d) 8

114. The number of non-empty subsets of the set $\{1, 2, 3, 4\}$ is $3 \times a$. The value of 'a' is
(a) 3 (b) 4
(c) 5 (d) 6

115. If $A = \phi$, then the number of elements in P(A) is
(a) 3 (b) 2
(c) 1 (d) 0

116. If $A = \{(x, y) : x^2 + y^2 = 25\}$ and $B = \{(x, y) : x^2 + 9y^2 = 144\}$ then the number of points, $A \cap B$ contains is
(a) 1 (b) 2
(c) 3 (d) 4

117. The cardinality of the set $P\{P[P(\phi)]\}$ is

(a) 0 (b) 1

(c) 2 (d) 4

118. If $n(A) = 8$ and $n(A \cap B) = 2$, then $n[(A \cap B)' \cap A]$ is equal to

(a) 8 (b) 6

(c) 4 (d) 2

119. In a school, there are 20 teachers who teach Mathematics or Physics of these, 12 teach Mathematics and 4 teach both Maths and Physics. Then the number of teachers teaching only Physics are

(a) 4 (b) 8

(c) 12 (d) 16

ASSERTION-REASON TYPE QUESTIONS

Directions : Each of these questions contains two statements, Assertion and Reason. Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.

(a) Assertion is correct, reason is correct; reason is a correct explanation for assertion.

(b) Assertion is correct, reason is correct; reason is not a correct explanation for assertion

(c) Assertion is correct, reason is incorrect

(d) Assertion is incorrect, reason is correct.

120. **Assertion :** The number of non-empty subsets of the set {a, b, c, d} are 15.
Reason : Number of non-empty subsets of a set having n elements are $2^n - 1$.

121. Suppose A, B and C are three arbitrary sets and U is a universal set.
Assertion : If $B = U - A$, then $n(B) = n(U) - n(A)$.
Reason : If $C = A - B$, then $n(C) = n(A) - n(B)$.

122. **Assertion :** Let $A = \{1, \{2, 3\}\}$, then $P(A) = \{\{1\}, \{2, 3\}, \phi, \{1, \{2, 3\}\}\}$.
Reason : Power set is set of all subsets of A.

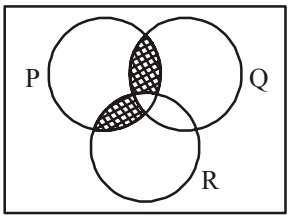
123. **Assertion :** The subsets of the set $\{1, \{2\}\}$ are $\{\}, \{1\}, \{\{2\}\}$ and $\{1, \{2\}\}$.
Reason : The total number of proper subsets of a set containing n elements is $2^n - 1$.

124. **Assertion :** For any two sets A and B, $A - B \subset B'$.
Reason : If A be any set, then $A \cap A' = \phi$.

CRITICAL THINKING TYPE QUESTIONS

Directions : This section contains multiple choice questions. Each question has four choices (a), (b), (c) and (d), out of which only one is correct.

125. What does the shaded portion of the Venn diagram given below represent?



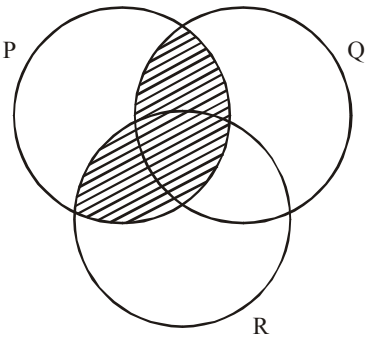
(a) $(P \cap Q) \cap (P \cap R)$

(b) $((P \cap Q) - R) \cup ((P \cap R) - Q)$

(c) $((P \cup Q) - R) \cap ((P \cap R) - Q)$

(d) $((P \cap Q) \cup R) \cap ((P \cup Q) - R)$

126. What does the shaded region represent in the figure given below ?



(a) $(P \cup Q) - (P \cap Q)$

(b) $P \cap (Q \cap R)$

(c) $(P \cap Q) \cap (P \cap R)$

(d) $(P \cap Q) \cup (P \cap R)$

127. Two finite sets have m and n elements. The total number of subsets of the first set is 56 more than the total number of subsets of the second set. The values of m and n are:

(a) 7, 6 (b) 6, 3

(c) 5, 1 (d) 8, 7

128. If A is the set of the divisors of the number 15, B is the set of prime numbers smaller than 10 and C is the set of even numbers smaller than 9, then $(A \cup C) \cap B$ is the set

(a) {1, 3, 5} (b) {1, 2, 3}

(c) {2, 3, 5} (d) {2, 5}

129. Let S = the set of all triangles, P = the set of all isosceles triangles, Q = the set of all equilateral triangles, R = the set of all right-angled triangles. What do the sets $P \cap Q$ and $R - P$ represents respectively ?

(a) The set of isosceles triangles; the set of non- isosceles right angled triangles

(b) The set of isosceles triangles; the set of right angled triangles

(c) The set of equilateral triangles; the set of right angled triangles

(d) The set of isosceles triangles; the set of equilateral triangles

130. If A and B are non-empty sets, then $P(A) \cup P(B)$ is equal to

(a) $P(A \cup B)$ (b) $P(A \cap B)$

(c) $P(A) = P(B)$ (d) None of these

131. Let $A = \{(1, 2), (3, 4), 5\}$, then which of the following is incorrect?

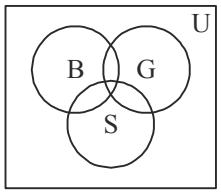
(a) $\{3, 4\} \notin A$ as $(3, 4)$ is an element of **A**

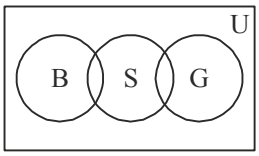
(b) $\{5\}, \{(3, 4)\}$ are subsets of A but not elements of A

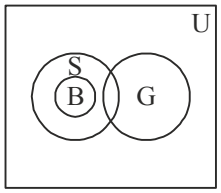
(c) $\{1, 2\}, \{5\}$ are subsets of A

(d) $\{(1, 2), (3, 4), 5\}$ are subset of A

132. Let U be the set of all boys and girls in school. G be the set of all girls in the school. B be the set of all boys in the school and S be the set of all students in the school who take swimming. Some but not all students in the school take swimming.

(a) 

(b) 

(c) 

(d) None of these

133. If $A = \{a, \{b\}\}$, then P(A) equals.

(a) $\{\phi, \{a\}, \{\{b\}\}, \{a, \{b\}\}\}$

(b) $\{\phi, \{a\}\}$

(c) $\{\{a\}, \{b\}, \phi\}$

(d) None of these

134. If A and B are two sets, then $(A - B) \cup (B - A) \cup (A \cap B)$ is equal to

(a) Only A (b) $A \cup B$

(c) $(A \cup B)'$ (d) None of these

135. A market research group conducted a survey of 2000 consumers and reported that 1720 consumers like product P_1 and 1450 consumers like product P_2. What is the least number that must have liked both the products?

(a) 1150 (b) 2000

(c) 1170 (d) 2500

136. In a town of 10000 families, it was found that 40% families buy newspaper A, 20% families buy newspaper B and 10% families buy newspaper C, 5% buy A and B, 3% buy B and C and 4% buy A and C. If 2% families buy all of three newspapers, then the number of families which buy A only, is

(a) 4400 (b) 3300

(c) 2000 (d) 500

137. A class has 175 students. The following data shows the number of students opting one or more subjects. Maths–100, Physics–70, Chemistry–40, Maths and Physics–30, Maths and Chemistry–28, Physics and Chemistry–23, Maths, Physics and Chemistry–18. How many have offered Maths alone?

(a) 35 (b) 48

(c) 60 (d) 22

138. If $aN = \{ax : x \in \mathbf{N}\}$, then the set $3N \cap 7N$ is

(a) $21N$ (b) $10N$ (c) $4N$ (d) None

139. If $A = \{x \in \mathbf{R} : 0 < x < 3\}$ and $B = \{x \in \mathbf{R} : 1 \le x \le 5\}$ then $A \Delta B$ is

(a) $\{x \in \mathbf{R} : 0 < x < 1\}$ (b) $\{x \in \mathbf{R} : 3 \le x \le 5\}$

(c) $\{x \in \mathbf{R} : 0 < x < 1 \text{ or } 3 \le x \le 5\}$ (d) ϕ

140. Let A, B, C be finite sets. Suppose that $n(A) = 10$, $n(B) = 15$, $n(C) = 20$, $n(A \cap B) = 8$ and $n(B \cap C) = 9$. Then the possible value of $n(A \cup B \cup C)$ is

(a) 26

(b) 27

(c) 28

(d) Any of the three values 26, 27, 28 is possible

141. A market research group conducted a survey of 1000 consumers and reported that 720 consumers liked product A and 450 consumers liked product B. What is the least number that must have liked both products ?

(a) 170 (b) 280

(c) 220 (d) None

142. Each student in a class of 40, studies at least one of the subjects English, Mathematics and Economics. 16 study English, 22 Economics and 26 Mathematics, 5 study English and Economics, 14 Mathematics and Economics and 2 study all the three subjects. The number of students who study English and Mathematics but not Economics is

(a) 7 (b) 5

(c) 10 (d) 4

143. A survey of 500 television viewers produced the following information, 285 watch football, 195 watch hockey, 115 watch basket-ball, 45 watch football and basket ball, 70 watch football and hockey, 50 watch hockey and basket ball, 50 do not watch any of the three games. The number of viewers, who watch exactly one of the three games are

(a) 325 (b) 310

(c) 405 (d) 372

144. 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:

(a) 128 (b) 216
(c) 240 (d) 160

145. Let A, B, C be three sets. If $A \in B$ and $B \subset C$, then

(a) $A \subset C$ (b) $A \not\subset C$
(c) $A \in C$ (d) $A \notin C$

146. Let $V = \{a, e, i, o, u\}$, $V - B = \{e, o\}$ and $B - V = \{k\}$. Then, the set B is

(a) {a, i, u} (b) {a, e, k, u}
(c) {a, i, k, u} (d) {a, e, i, k, u}

147. From 50 students taking examination in Mathematics, Physics and Chemistry, each of the students has passed in at least one of the subject, 37 passed Mathematics, 24 Physics and 43 Chemistry. Atmost 19 passed Mathematics and Physics, atmost 29 Mathematics and Chemistry and atmost 20 Physics and Chemistry. Then, the largest numbers that could have passed all three examinations, are

(a) 12 (b) 14
(c) 15 (d) 16

HINTS AND SOLUTIONS

CONCEPT TYPE QUESTIONS

1. **(d)** **2.** **(a)** **3.** **(b)**

4. **(b)** **Note:** $(A \cup B)' = A' \cap B'$ (By De-morgan's law) and $(A \cap B)' = A' \cup B'$

5. **(d)** The number of proper subsets of $\{1, 2, 3, ... n\}$ is $2^n - 1$.
Hence the number of proper subset of {a, b, c} is $2^3 - 1 = 7$

6. **(c)** A set which does not contain any element is called an empty or void or null set.
But zero set contain 0.

7. **(a)** Given $A = \{1, 2, 3, 4\}, B = \{3, 4, 5, 6\}$
$\therefore A - B = \{1, 2\}$

8. **(d)** Let A = {x, y}
Power set = Set of all possible subsets of A
$\therefore$ P(A) = $\{\phi, \{x\}, \{y\}, \{x, y\}\}$

9. **(a)** **10.** **(c)** **11.** **(a)**

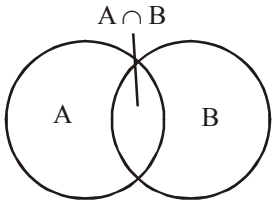
12. **(a)** The days of a week are well defined.
Hence, the collection of all the days of a week, is a set.

13. **(d)**

14. **(a)** We have, $V = \{a, e, i, o, u\}$ and
$B = \{a, i, k, u\}$
$\therefore V - B = \{e, o\}$
$\because$ the element e, o belong to V but not to B
$\therefore B - V = \{k\}$
$\because$ the element k belong to $B - V$ but not to $V - B$.

15. **(c)** $A \cup B = \{a, b\} \cup \{a, b, c\} = \{a, b, c\}$

16. **(c)** If A and B are finite sets, then



$A - B = A - (A \cap B)$
From the Venn diagram
$\Rightarrow n(A - B) = n(A) - n(A \cap B)$

17. **(b)** Since, ϕ is an empty set, $\phi \in \{\phi\}$

18. **(d)** In the given sets, the set of all primes is an infinite set.

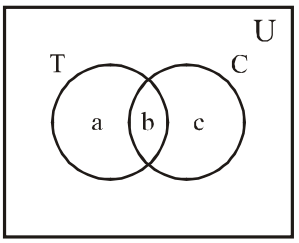
19. **(a)** Given : A = {3, 6, 9, 15....} and
B = {5, 10, 15, 20,.....}
$A \cap B = \{x : x$ is multiple of 3 and $5\}$
$\Rightarrow A \cap B = \{x : x$ is multiple of $15\}$
$\Rightarrow A \cap B = \{15, 30, 45, ...\}$

20. **(a)** We have $x^2 = 16 \Rightarrow x = \pm 4$
Also, $2x = 6 \Rightarrow x = 3$
There is no value of x which satisfies both the above equations. Thus the set A contains no elements
$\therefore A = \phi$

21. **(c)** Clearly $A = \phi = \{\}$

22. **(d)** $x^2 + 1 = 0$ has no solution in R

23. **(d)** Let T denotes tea drinkers and C denotes coffee drinkers in universal set U.



From the diagram, we get
$a + b + c = 52$ ...(i)
$a = 16$ ...(ii)
$a + b = 33$ ...(iii)
Put a = 16 in equation (iii), we have
$16 + b = 33 \Rightarrow b = 17$
Now, substitute the values of a and b in equation (i), we get
$16 + 17 + c = 52$
$c = 52 - 33 = 19$

24. **(a)** Let A $\equiv$ Set of Tamil speaking students and
B $\equiv$ Hindi speaking students
$n(A) = 400, n(B) = 300$ and $n(A \cup B) = 600$
$n(A \cup B) = n(A) + n(B) - n(A \cap B)$
$\Rightarrow n(A \cap B) = n(A) + n(B) - n(A \cup B)$
$= 400 + 300 - 600 = 100$

25. **(b)** Total number of students = 500
Let H be the set showing number of students who can speak Hindi = 475 and B be the set showing number of students who can speak Bengali = 200
So, n (H) = 475 and n (B) = 200 and given that
$n(B \cup H) = 500$
we have
$n(B \cup H) = n(B) + n(H) - n(B \cap H)$
$\Rightarrow 500 = 200 + 475 - n(B \cap H)$
so, $n(B \cap H) = 175$
Hence, persons who speak Hindi only = $n(H) - n(B \cap H)$
$= 475 - 175 = 300$

26. **(b)** Given, $A = \{3, 6, 9, 12\}$
$= \{x : x = 3n, n \in N \text{ and } 1 \le n \le 4\}$
and $B = \{1, 4, 9, ..., 100\}$
$= \{x : x = n^2, n \in N \text{ and } 1 \le n \le 10\}$

27. **(a)** (a) $A = \{x : x \in Z \text{ and } x^2 - 5x + 6 = 0\} = \{2, 3\}$
So, A is a finite set
(b) $B = \{x : x \in Z \text{ and } x^2 \text{ is even}\}$
$= \{....., -6, -4, -2, 0, 2, 4, 6, ...\}$
Clearly, B is an infinite set.
(c) $D = \{x : x \in Z \text{ and } x > -10\}$
$= \{-9, -8, -7, ...\}$
Clearly, D is an infinite set.

28. **(a)**
(a) $|x| = 5 \Rightarrow x = 5 \quad [\because x \in N]$
$\therefore$ Given set is singleton.
(b) $|x| = 6 \Rightarrow x = -6, 6 \quad [\because x \in Z]$
$\therefore$ Given set is not singleton.
(c) $x^2 + 2x + 1 = 0 \Rightarrow (x + 1)^2 = 0$
$\Rightarrow x = -1, -1$
Since, $-1 \notin N$, $\therefore$ given set = ϕ
(d) $x^2 = 7 \Rightarrow x = \pm\sqrt{7}$.

29. **(b)**
(a) There is no odd natural number divisible by 2, so there will be no element in this set, hence it is a null set.
(b) There is only one even prime number which is 2, i.e. there is an element, so it is not a null set.
(c) There is no natural number which is less than 5 and greater than 7, i.e. there is no element, so it is a null set.
(d) Since, parallel lines never intersect each other, so they have no common point, i.e. no element, so it is a null set.

30. **(c)** Given that $A = \{x : x = n^2, n = 1, 2, 3\} = \{1, 4, 9\}$
$\therefore$ Number of elements in A is 3.
So, number of proper subsets = $2^3 - 1 = 7$.

31. **(a)** Subset of { } i.e., ϕ is ϕ.
Subsets of {4} are ϕ, {4}.
Subsets of {4, 5} are ϕ, {4}, {5}, {4, 5}.
Subsets of {0} are ϕ, {0}.

32. **(d)** It is clear from the figure that set $A \cup C$ is not shaded and set B is shaded other than $A \cup C$, i.e., $B - (A \cup C)$.

33. **(b)**

34. **(c)** $A \cap (A \cup B)' = A \cap (A' \cap B') = (A \cap A') \cap B'$
$= \phi \cap B' = \phi$.

35. **(c)** Let A and B be the two sets of news channel such that n(A) = 63, n(B) = 76, $n(A \cup B) = 100$
Also, $n(A \cap B) = x$
Using, $n(A \cup B) = n(A) + n(B) - n(A \cap B)$
$\Rightarrow 100 = 63 + 76 - x$
$\Rightarrow x = 139 - 100 = 39$
Again, $n(A \cap B) \le n(A)$
$\Rightarrow x \le 63$
$\therefore 39 \le x \le 63$.

36. **(c)** We see that each member in the given set has the numerator one less than the denominator. Also, the numerator begins from 1 and do not exceed 6. Hence, in the set-builder form, the given set is
$$\left\{x : x = \frac{n}{n+1}, \text{ where } n \in N \text{ and } 1 \le n \le 6\right\}.$$

37. **(a)** Since, $3^x - 1$ is an even number for all $x \in Z^+$. So, the given set in roster form is {1, 2, 3, 4, 5}.

38. **(c)** A student cannot study simultaneously in both classes X and XI. Thus, the set B contains no element at all.

39. **(a)** We note that every element of Y is also an element of X, as if a student is in your class, then he is also in your school.

40. **(a)** If $A \subset B$ and $A \ne B$, then A is called a proper subset of B and B is called a super set of A.

41. **(a)** Let $a, b \in R$ and $a < b$. Then, the set of real numbers $\{x : a < x < b\}$ is called an open interval. And a, b do not belong to this interval.

42. **(d)** a is not an element of {{a}, b}
$\therefore a \notin \{\{a\}, b\}$
{b, c} is the element of {a, {b, c}}
$\therefore \{b, c\} \in \{a, \{b, c\}\}$
$b \in \{a, b\}$ but $b \notin \{a, \{b, c\}\}$
$\therefore \{a, b\} \not\subset \{a, \{b, c\}\}$.

43. **(b)**


represents [a, b).


represents (a, b].

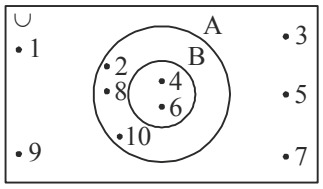
represents (a, b).


represents [a, b].

44. **(b)** The interval in the figure is [a, b].

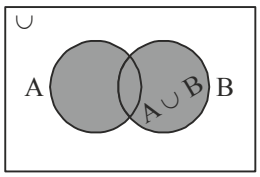
45. **(c)** $n[P(\phi)] = 2^0 = 1 \quad [\because n(\phi) = 0]$
$n[P(P(\phi))] = 2^1 = 2$
$n[P\{P(P(\phi))\}] = 2^2 = 4$.

46. **(d)** $U = \{1, 2, 3, 4, ..., 10\}$
$A = \{2, 4, 6, 8, 10\}$
$B = \{4, 6\}$
$\because$ All the elements of B are also in A.
$\therefore$ $B \subset A$
$\Rightarrow$ Set B lies inside A in the Venn diagram.



47. **(c)** Most of the relationships between sets can be represented by Venn diagrams.

48. **(c)** The union of two sets A and B can be represented by a Venn diagram as

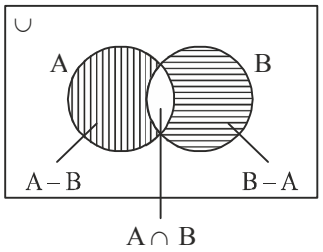


49. **(c)** Here, X = {Ram, Geeta, Akbar}
and Y = {Geeta, David, Ashok}
Then, $X \cap Y = \{Geeta\}$

50. **(b)** Using the set-builder form, we can write the definition of difference as
$$A - B = \{x : x \in A \text{ and } x \notin B\}$$

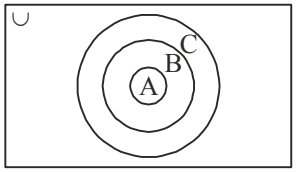
51. **(d)** The shaded region in the figure is $A - (B \cup C)$.

52. **(c)**



Clearly, $(A \cup B) - (A \cap B) = (A - B) \cup (B - A)$

53. **(c)** If $A \subset B$ and $B \subset C$, then these sets is represented in Venn diagram as



Clearly, $A \cup B = B$
and $B \cap C = B$
Hence, $A \cup B = B \cap C$.

54. **(a)** In the given figure, the shaded portion represents complement of set A.

55. **(c)** $B \cup C = \{2, 3, 4, 6, 7, 8\}$

$(B \cup C)' = U - (B \cup C) = \{1, 5, 9, 10\}$

$C - A = \{4, 8\}$

$(C - A)' = \{1, 2, 3, 5, 6, 7, 9, 10\}$.

56. **(d)** $A \cap (A \cap B)^c = A \cap (A^c \cup B^c)$
$= (A \cap A^c) \cup (A \cap B^c) = \phi \cup (A \cap B^c) = A \cap B^c$.

57. **(a)** $A \cap B \subseteq A$. Hence, $A \cup (A \cap B) = A$.

58. **(b)** Given $A \cup \{1, 2\} = \{1, 2, 3, 5, 9\}$.
Hence, $A = \{3, 5, 9\}$

59. **(c)** $A \cap (A \cup B)' = A \cap (A' \cap B')$,

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

$= (A \cap A') \cap B'$, [By associative law]

$= \phi \cap B'$, $\left[\because A \cap A' = \phi\right]$

$= \phi$.

60. **(a)** $A \cap (B - A) = \phi$ $[\because x \in B - A \Rightarrow x \notin A]$

61. **(b)** $A - B = \{1\}$ and $B - C = \{4\}$
$(A - B) \times (B - C) = \{(1, 4)\}$.

62. **(c)** Since $A \subseteq B$,
$\therefore$ $A \cup B = B$
So, $n(A \cup B) = n(B) = 6$.

63. **(a)** Minimum value of $x = 100 - (30 + 20 + 25 + 15)$
$= 100 - 90 = 10$.

64. **(b)** $A = \{4, 8, 12, 16, 20, 24, ...\}$
$B = \{6, 12, 18, 24, 30, ...\}$
$\therefore$ $A \subset B = \{12, 24, ...\} = \{x : x \text{ is a multiple of } 12\}$.

STATEMENT TYPE QUESTIONS

65. **(b)** As given, P ≡ set of square, Q ≡ set of parallelogram, R ≡ set of quadrilaterals and S ≡ set of rectangles.
Since all squares are parallelogram
$\Rightarrow$ $P \subset Q$
Since, all squares are rectangles, $\therefore$ $P \subset S$ and also all rectangles are quadrilateral, $\therefore$ $S \subset R$
$\Rightarrow$ 1, 3 and 4 are correct

66. **(d)** Both statements are incorrect.

67. **(b)**

68. **(d)** Let us consider the sets
$A = \{1, 2, 4\}$, $B = \{2, 5, 6\}$ and $C = \{1, 5, 7\}$
I. $A - B = \{1, 4\}$ and $A - (A \cap B)$
$= \{1, 2, 4\} - \{2\} = \{1, 4\}$
$\therefore$ $A - B = A - (A \cap B)$
II. $(A \cap B) \cup (A - B)$
$= \{2\} \cup \{1, 4\} = \{1, 2, 4\} = A$

III. $A-(B\cup C)=\{1,2,4\}-\{1,2,5,6,7\}=\{4\}$ and $(A-B)\cup(A-C)=\{1,4\}\cup\{2,4\}=\{1,2,4\}$

$\therefore$ $A-(B\cup C)\neq(A-B)\cup(A-C)$.

69. (c) In (i) and (iii), we can definitely decide whether a given particular object belongs to a given collection or not. For example, we can say that the river Nile does not belong to the collection of rivers of India. On the other hand, the river Ganga belongs to this collection.

Again, the collection of most talented batsmen of India and the collection of books is not well-defined, because the criterion for determining most talented batsman and collection of particular kind of books may vary from person-to-person.

70. (c) While writing the set in roster form, an element is not generally repeated, i.e. all elements are taken as distinct. The set of letters forming the word 'SCHOOL' is {S, C, H, O, L} or {H, O, L, C, S}. Here, the order of listing elements has no relevance. We can also express it as {S, C, H, O, L}.

71. (c) The collection of all months of a year beginning with the letter J and the collection of all boys in your class are well-defined. But the collection of ten most talented writers of India and a team of eleven best cricket batsmen of the world may vary from person-to-person, so these are not well defined. Hence, I and IV represent the sets.

72. (b) We can write $60 = 2 \times 2 \times 3 \times 5$

$\therefore$ Prime factors of 60 are 2, 3 and 5.

Hence, the set D in roster form is {2, 3, 5}.

There are 12 letters in the word 'TRIGONOMETRY' out of which three letters T, R and O are repeated. Hence, set E in the roster form is {T, R, I, G, O, N, M, E, Y}.

73. (b) The empty set is denoted by the symbol ϕ or { }.

74. (b) The set of real numbers which satisfy $x^2 - 1 = 0$ is $\{-1, 1\}$.

So, Statement I is false.

Given, $x^2 = 16$ and $2x = 6$

$x = 4, -4$ and $x = 3$

$\therefore$ There is no real x which simultaneously satisfied $x^2 = 16$ and $2x = 6$.

So, Statement II is true.

75. (c) We do not know the number of animals living on the Earth, but it is some natural number. So, the set of animals living on the Earth is finite. There are infinite circles passing through the origin (0, 0). So, the set of circles passing through the origin (0, 0) is infinite.

76. (c) There are infinite positive integer greater than 100. So, the set of positive integers greater than 100 is infinite.

There are 25 prime numbers less than 99.

So, the set of prime numbers less than 99 is finite.

77. (a) There are infinite lines parallel to X-axis. So, the set of lines parallel to X-axis is infinite.

There are infinite numbers which are multiple of 5. So, the set of numbers, which are multiple of 5, is infinite.

There are 26 letters in the English alphabet. So, the set of letters in the English alphabet is finite.

78. (c) Since, $0 \in A$ and 0 does not belong to any of the sets B, C, D and E, it follows that $A \neq B$, $A \neq C$, $A \neq D$, $A \neq E$.

Since, $B = \phi$, but none of the other sets are empty. Therefore $B \neq C$, $B \neq D$ and $B \neq E$. Also, $C = \{5\}$ but $-5 \in D$, hence $C \neq D$.

Since, $E = \{5\}$, $C = E$. Further, $D = \{-5, 5\}$ and $E = \{5\}$, we find that $D \neq E$. Thus, the only one pair of equal sets is C and E.

79. (c) There are infinite concentric circles in a plane. So, the given set is infinite.

Now, $x^2 - 3 = 0$

or $x^2 = 3$

or $x = \pm\sqrt{3}$

Thus, there is no rational number satisfied $x^2 - 3 = 0$. So, given set is null set.

80. (c) From the definition of subset, it follows that every set is a subset of itself. Since, the empty set ϕ has no element, we agree to say that ϕ is a subset of every set.

81. (c) $A = \{1, 3, 5\}$

$B = \{x : x \text{ is an odd natural number less than } 6\}$

$= \{1, 3, 5\}$

Since, every element of A is in B, so $A \subset B$.

Every element of B is in A, so $B \subset A$.

Then, $A = B$.

82. (b) The universal set must contain the elements 0, 1, 2, 3, 4, 5, 6 and 8.

83. (b) From all the three sets, set of all triangles in a plane is the universal set for set of isosceles triangle.

84. (a) Let A and B be two sets. Symbolically, the union of A and B write as $A \cup B$ and the common elements of A and B being taken only once.

85. (b) $A = \{a, b\}$, $B = \{a, b, c\}$

Since, all the elements of A are in B.

So, $A \subset B$.

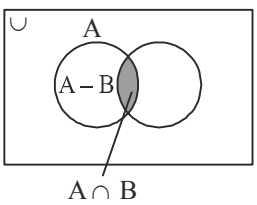
Hence, Statement I is false.

$\because$ $A \subset B$

$\Rightarrow$ $A \cup B = B$

Therefore, Statement II is true.

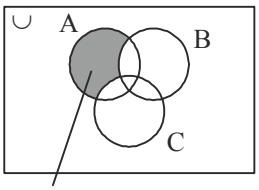
86. (a) I.



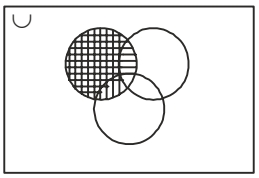
It is clear from the Venn diagram
$A - B = A - (A \cap B)$

II. Also, it is clear from above diagram
$A = (A \cap B) \cup (A - B)$

III.



$A - (B \cup C)$



≡ (horizontal) lines : $A - C$
ǁ (vertical) lines : $A - B$

It is clear from the diagrams
$A - (B \cup C) = (A - B) \cap (A - C)$

87. (c) If A is a subset of the universal set U, then its complement A' is also a subset of U.

We have, $A' = \{2, 4, 6, 8, 10\}$

Hence, $(A')' = \{x : x \in U \text{ and } x \notin A'\}$

$= \{1, 3, 5, 7, 9\} = A$

It is clear from the definition of the complement that for any subset of the universal set U, we have

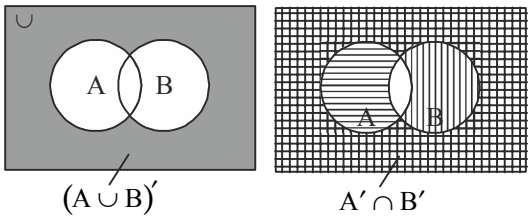
$$(A')' = A$$

88. (b) Let U be the uni versal set and A is a subset of U. Then, the complement of A is the set of all elements of U which are not the elements of A. Symbolically, we write A' to denote the complement of A with respect to U. Thus,

$A' = \{x : x \in U \text{ and } x \notin A\}$

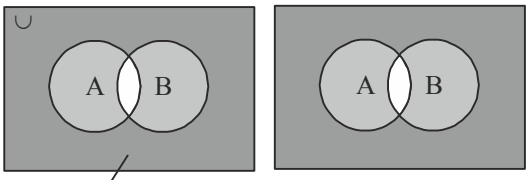
Obviously, $A' = U - A$

89. (c)



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

Clearly, $(A \cup B)'$ and $A' \cap B'$ are same.



$(A \cap B)'$ The shaded region is $A' \cup B'$

Clearly, $(A \cap B)'$ and $A' \cup B'$ are same.

90. (a) If A, B and C are finite sets, then

$n(A \cup B \cup C) = n(A) + n(B \cup C) - n[A \cap (B \cup C)]$

$[\because n(A \cup B) = n(A) + n(B) - n(A \cap B)]$

$= n(A) + n(B) + n(C) - n(B \cap C)$

$- n[A \cap (B \cup C)]$ ... (i)

Since, $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$, we get

$n[A \cap (B \cup C)] = n(A \cap B) + n(A \cap C)$

$- n[(A \cap B) \cap (A \cap C)]$

$= n(A \cap B) + n(A \cap C) - n(A \cap B \cap C)$

Therefore, $n(A \cup B \cup C) = n(A) + n(B) + n(C)$

$- n(A \cap B) - n(B \cap C) - n(A \cap C)$

$+ n(A \cap B \cap C)$

Now, if A, B and C are mutually pairwise disjoint, then

$A \cap B = \phi = B \cap C = A \cap C = A \cap B \cap C$

$\therefore$ $n(A \cup B \cup C) = n(A) + n(B) + n(C)$.

91. (b) Let U denote the set of surveyed students and X denote the set of students taking apple juice and Y denote the set of students taking orange juice. Then,

$n(U) = 400$, $n(X) = 100$, $n(Y) = 150$

and $n(X \cap Y) = 75$

$n(X \cup Y) = n(X) + n(Y) - n(X \cap Y)$

$= 100 + 150 - 75$

$= 175$

$\therefore$ 175 students were taking at least one juice.

$n(X' \cap Y') = n(X \cup Y)'$

$= n(U) - n(X \cup Y)$

$= 400 - 175$

$= 225$

Hence, 225 students were taking neither apple juice nor orange juice.

92. (a) Let $X \in P(A \cap B)$ ...(i)

$\Leftrightarrow$ $x \subset A$ and $x \subset B$

$\Leftrightarrow$ $x \in P(A)$ and $x \in P(B)$

$\Leftrightarrow$ $x \in [P(A) \cap P(B)]$ ...(ii)

Hence, from (i) and (ii)

$P(A) \cap P(B) = P(A \cap B)$

Now, $P(A) \cup P(B) \neq P(A \cup B)$, we can prove it by an example.

93. (c) Let $A = \{1, 2, 3, \ldots, n\}$

No. of subsets of $A = 2^n$

$\therefore$ $2^n = 128 \Rightarrow 2^n = 2^7 \Rightarrow n = 7$

$\therefore$ Number of elements in set A = 7

94. (d) Let X = {a, b, c, d}

n(X) = 4

No. of subsets of X = $2^4 = 16$

No. of non-empty subsets of A = 16 – 1 = 15

($\because$ Only one set is empty set)

95. (c) I. $A \cup B = \{1, 2, 3, 4, 5, 6\}$

$(A \cup B) \cap C = \{3, 4, 6\}$

II. De-Morgan's law.

96. (a) Only I and II statements are incorrect.

I. $A - B = \{3, 6, 9, 15, 18, 21\}$

II. $C - B = \{2, 6, 10, 14, 20\}$

$D - B = \{5, 10, 15\}$

$(C - B) \cap (D - B) = \{10\}$

97. (c) Both the statements are true.

II. $n(S \cup T) = n(S) + n(T) - n(S \cap T)$

$= 720 + 450 - n(S \cap T)$

$= 1170 - n(S \cap T)$

$1170 - n(S \cap T) \le n(U)$

$1170 - n(S \cap T) \le 1000$

$\Rightarrow n(S \cap T) \ge 170$

98. (a) Only statement-I is true.

I. Consider $A = B \cap C$

$= (C \cap A) \cap C \Rightarrow A = C \cap A \Rightarrow A = B$

II. $A = \{a, b\}$

$P(A) = \{\phi, \{a\}, \{b\}, \{a, b\}\}$

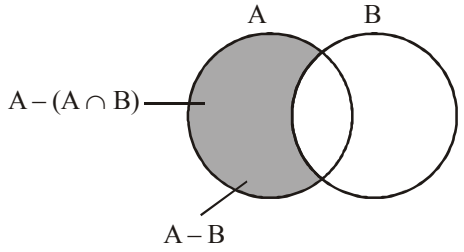
$A \cap P(A) = \phi$

99. (b) I and II are the correct statements.

$A - B = A - (A \cap B)$ is correct.

$A = (A \cap B) \cup (A - B)$ is correct.

Statement-III is false.



100. (c) I. $\bigcup_{n=2}^{10} A_n$ is the set of first 10 prime numbers

$= \{2, 3, 5, 7, 11, 13, 17, 19, 23, 29\}$

II. $n(A \cup B) = n(A) + n(B) - n(A \cap B)$

$50 = 28 + 32 - n(A \cap B)$

$n(A \cap B) = 60 - 50 = 10$

101. (c) By definition of union and intersection of two sets, both the statements are true.

MATCHING TYPE QUESTIONS

102. (b) If A is a subset of B, we write $A \subset B$ and if A is not a subset of B, then we write $A \not\subset B$.

In other words, $A \subset B$ if $a \in A$, then $a \in B$.

Now, if $A \subset B \Rightarrow$ Every element of A is in B and $B \subset A \Rightarrow$ Every element of B is in A, then we can say A and B are the same set, so that we have $A \subset B$ and $B \subset A \Leftrightarrow A = B$,

where '$\Leftrightarrow$' is a symbol for two way implications and usually read as if and only if (briefly written as "iff").

103. (d) The open interval $a < x < b$ is represented by (a, b) or]a, b[. The interval $a \le x \le b$ contain end points also is called closed interval and is denoted by [a, b]. The interval $a \le x < b$ closed at the end a and open at the end b, i.e. [a, b). Similarly, the interval $a < x \le b$ is represented by (a, b].

104. (c) Some properties of operation of intersection are as follows:

A. $A \cap B = B \cap A$ [commutative law]

B. $(A \cap B) \cap C = A \cap (B \cap C)$ [associative law]

C. $\phi \cap A = \phi$ [law of ϕ]

D. $U \cap A = A$ [law of U]

E. $A \cap A = A$ [idempotent law]

F. $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$ [distributive law]

105. (b) By properties of complement of a set,

A. $A \cup A' = U$

B. $A \cap A' = \phi$

By De-Morgan's laws,

C. $(A \cup B)' = A' \cap B'$

D. $(A \cap B)' = A' \cup B'$

By laws of empty set and universal set,

E. $\phi' = U$ and

F. $U' = \phi$

By law of double complementation,

G $(A')' = A$.

106. (d)

107. (d)

(A) Let $x \in A$, then $x \in A \cup B$

$\Rightarrow x \in A \cap B$ ($\because A \cup B = A \cap B$)

$\Rightarrow x \in B$

$\therefore A \subset B$ …(i)

Similarly, if $y \in B$, then $y \in A \cap B$

$\Rightarrow y \in A$

$\therefore B \subset A$ …(ii)

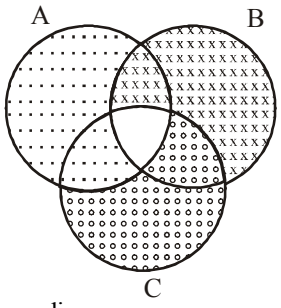
From (i) & (ii), A = B

(C) Let $a \in A$, then there exists $x \in P(A)$ such that $a \in X$.

$\Rightarrow x \in P(B)$ $(\because P(A) = P(B))$
$\Rightarrow a \in B$
$\Rightarrow A \subset B$ …(i)
Similarly, we can prove $B \subset A$ …(ii)
from (i) and (ii), we have $A = B$

(D) $A \cup (B - A) = A \cup (B \cap A') = A \cup B$

(E)



From Venn - diagram
$(A - B) \cup (B - C) \cup (C - A) = (A \cap B \cap C)$.

108. (b) **109. (c)**

INTEGER TYPE QUESTIONS

110. (a) Since, $a + 2 = 6 \Rightarrow a = 4$
$\therefore$ the given set is $\{4\}$.

111. (d) An empty set does not contain any element.

112. (d) Number of elements in $X = 5$

113. (c) $n(X) = 3$
Number of proper subset $= 2^{n(x)} - 1$
$= 2^3 - 1 = 8 - 1 = 7$

114. (c) Total number of subset of given set $\{1, 2, 3, 4\} = 2^4 = 16$
Since, ϕ is the subset of every set.
$\therefore$ Number of non-empty subsets $= 16 - 1 = 15 = 3 \times 5$

115. (c) $n(A) = 0$
$n[P(A)] = 2^0 = 1$

116. (d) A is the set of points on circle.
B is the set of points on ellipse. These two intersects at four points.
$\therefore$ $A \cap B$ contains four points.

117. (d) $P(\phi)$ is the power set of the set ϕ.
$\therefore$ Cardinality $= P\{P[P(\phi)]\} = 4$

118. (b) $n[(A \cap B)' \cap A] = n[(A' \cup B') \cap A]$
$= n[(A' \cap A) \cup (B' \cap A)]$ (Distributive Law)
$= n[\phi \cup (B' \cap A)] = n(A \cap B') = n(A) - n(A \cap B)$

119. (b) Let M = set of Mathematics teachers
P = set of Physics teachers
n(only Maths teacher) $= n(M) - n(M \cap P) = 12 - 4 = 8$
Also, $n(M \cup P) = n$ (only Math teachers)
$+ n$(Only Physics teachers) $+ n(M \cap P)$
$20 = 8 + 4 + n$ (only Physics teachers)
$\Rightarrow n = 8$.

ASSERTION-REASON TYPE QUESTIONS

120. (a) $A = \{a, b, c, d\}$
$\therefore$ $n(A) = 4$
$\therefore$ Number of subsets of $A = 2^4 = 16$, out of which only one set is empty set because empty set is subset of every set.
$\therefore$ Number of non-empty subsets of $A = 2^4 - 1 = 15$.

121. (c) If U is a universal set, then $B = U - A = A'$, for which $n(B) = n(A') = n(U) - n(A)$.
But for any three arbitrary sets A, B and C, we cannot always have $n(C) = n(A) - n(B)$, if $C = A - B$ as it is not specified here whether A is universal set or not. In case if A is not universal set, then we cannot conclude.
$n(C) = n(A) - n(B)$.
Hence, Assertion is true but Reason is false.

122. (d) As $A = \{1, \{2, 3\}\}$
$\therefore$ Subsets of $A = \phi, \{1\}, \{\{2, 3\}\}, \{1, \{2, 3\}\}$
Now, $\{\{2, 3\}\} \subset A$
$\therefore$ $\{\{2, 3\}\} \in P(A)$
$\therefore$ Assertion is false but Reason is obviously true.

123. (b) $\{1\}$ and $\{2\}$ are the element of $\{1, \{2\}\}$.
So, the subsets of the set $\{1, \{2\}\}$ are $\phi, \{1\}, \{\{2\}\}$ and $\{1, \{2\}\}$.
Hence, Assertion is true.
We know, total number of proper subsets of a set containing n elements is $2^n - 1$.
Hence, Reason is true. But Reason is not the correct explanation of Assertion.

124. (b) Let $x \in A - B$
$\Rightarrow$ $x \in A$ and $x \notin B$
$\Rightarrow$ $x \in A$ and $x \in B'$
$\Rightarrow$ $x \in B'$
$\therefore$ $A - B \subset B'$
It is true $A \cap A' = \phi$ [by complement laws]
Hence, both Assertion and Reason are correct but Reason is not a correct explanation of Assertion.

CRITICAL THINKING TYPE QUESTIONS

125. (b) In the given Venn diagram, shaded area between sets P an Q is $(P \cap Q) - R$ and shaded area between P and R is $(P \cap R) - Q$. So, both the shaded area is union of these two area and is represented by
$((P \cap Q) - R) \cup ((P \cap R) - Q)$.

126. (d) The shaded region represents $(P \cap Q) \cup (P \cap R)$.

127. (b) Given : Two finite sets have m and n elements
$\therefore$ $2^m - 2^n = 56$

$\Rightarrow \quad 2^m - 2^n = 64 - 8$

$\Rightarrow \quad 2^m - 2^n = 2^6 - 2^3$

$\Rightarrow \quad m = 6, n = 3$

128. (c) $A = \{1, 3, 5, 15\}, B = \{2, 3, 5, 7\}, C = \{2, 4, 6, 8\}$

$\therefore A \cup C = \{1,2,3,4,5,6,8,15\}$

$(A \cup C) \cap B = \{2, 3, 5\}$

129. (a) As given :

S = the set of all triangles

P = the set of all isosceles triangles

Q = the set of all equilateral triangles

R = the set of all right angled triangles

$\therefore$ $P \cap Q$ represents the set of isosceles triangles and $R - P$ represents the set of non-isosceles right angled triangles.

130. (d) Let A = {1}, B = {2, 3}, then

$A \cup B = \{1, 2, 3\}$ and $A \cap B = \phi$

Now, $P(A) = \{\phi, \{1\}\}$, $P(B) = \{\phi, \{2\}, \{3\}, \{2, 3\}\}$

$\therefore$ $P(A) \cup P(B) = \{\phi, \{1\}, \{2\}, \{3\}, \{2, 3\}\}$

$P(A \cup B) = \{\phi, \{1\}, \{2\}, \{3\}, \{2, 3\}, \{1, 2\}, \{3, 1\}, \{1, 2, 3\}\}$

and $P(A \cap B) = \{\phi\}$.

131. (c) {5} is a subset of A as $5 \in A$

But, {1, 2} is not a subset of A as elements $1, 2 \notin A$.

132. (b)

133. (a) Let B = {b}. Then, A = {a, B}.

$\therefore$ $P(A) = \{\phi, \{a\}, \{B\}, \{a, B\}\}$

$= \{\phi, \{a\}, \{\{b\}\}, \{a, \{b\}\}\}$.

134. (b) $(A - B) \cup (B - A) \cup (A \cap B)$

= only A $\cup$ only B $\cup$ Both A and B

$= A \cup B$.

135. (c) Let U be the set of all consumers who were questioned, A be the set of consumers who liked product P_1 and B be the set of consumers who liked product P_2.

It is given that $n(U) = 2000, n(A) = 1720, n(B) = 1450$,

$n(A \cup B) = n(A) + n(B) - n(A \cap B)$

$= 1720 + 1450 - n(A \cap B)$

$= 3170 - n(A \cap B)$

Since, $A \cup B \subseteq U$

$\therefore$ $n(A \cup B) \le n(U)$

$\Rightarrow$ $3170 - n(A \cap B) \le 2000$

$\Rightarrow$ $3170 - 2000 \le n(A \cap B)$

$\Rightarrow$ $n(A \cap B) \ge 1170$

Thus, the least value of $n(A \cap B)$ is 1170.

Hence, the least number of consumers who liked both the products is 1170.

136. (b) $n(A) = 40\%$ of $10000 = 4000$, $n(B) = 2000$,

$n(C) = 1000$, $n(A \cap B) = 500$, $n(B \cap C) = 300$,

$n(C \cap A) = 400$, $n(A \cap B \cap C) = 200$

$\therefore \quad n\left(A \cap \overline{B} \cap \overline{C}\right) = n\left\{A \cap (B \cup C)'\right\}$

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

$= n(A) - n(A \cap B) - n(A \cap C) + n(A \cap B \cap C)$

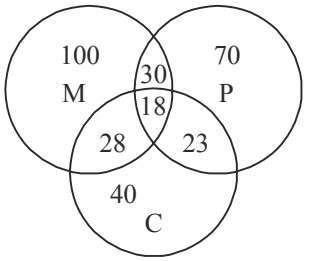
$= 4000 - 500 - 400 + 200 = 3300.$

137. (c) $n(M \cap P' \cap C')$

$= n(M) - [n(M \cap P) + n(M \cap C) - n(M \cap C \cap P)]$

$= 100 - 30 - 28 + 18 = 60$

[This can be solved directly by seeing the Venn Diagram]



138. (a) We have,

$3N = \{3x : x \in \mathbf{N}\} = \{3, 6, 9, 12, 15, 18, 21, 24.....\}$

$= \{x \in \mathbf{N} : x \text{ is a multiple of } 3\}$

and $7N = \{7x : x \in \mathbf{N}\} = \{7, 14, 21, 28.....\}$

$= \{x \in \mathbf{N} : x \text{ is a multiple of } 7\}$

$\therefore 3N \cap 7N = \{x \in \mathbf{N} : x \text{ is a multiple of 3 and 7}\}$

$= \{x \in N : x \text{ is a multiple of } 21\} = \{21, 42, ...\}$

$= 21N$

139. (c) From the given we have in interval notation A = (0, 3) and B = [1, 5]

Clearly $A - B = (0, 1) = \{x \in \mathbf{R} : 0 < x < 1\}$

and $B - A = [3, 5] = \{x \in \mathbf{R} : 3 \le x \le 5\}$

$\therefore A \Delta B = (A - B) \cup (B - A) = (0, 1) \cup [3, 5]$

$= \{x \in \mathbf{R} : 0 < x < 1 \text{ or } 3 \le x \le 5\}$

140. (d) We have

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

$= 10 + 15 + 20 - 8 - 9 - n(C \cap A) + n(A \cap B \cap C)$

$= 28 - \{n(C \cap A) - n(A \cap B \cap C)\}$ ...(i)

Since $n(C \cap A) \ge n(A \cap B \cap C)$

We have $n(C \cap A) - n(A \cap B \cap C) \ge 0$ ...(ii)

From (i) and (ii)

$n(A \cup B \cup C) \le 28$ ...(iii)

Now, $n(A \cup B) = n(A) + n(B) - n(A \cap B)$

$= 10 + 15 - 8 = 17$

and $n(B \cup C) = n(B) + n(C) - n(B \cap C)$

$= 15 + 20 - 9 = 26$

Since, $n(A \cup B \cup C) \ge n(A \cup C)$ and

$n(A \cup B \cup C) \geq n(B \cup C)$, we have

$n(A \cup B \cup C) \geq 17$ and $n(A \cup B \cup C) \geq 26$

Hence $n(A \cup B \cup C) \geq 26$ ...(iv)

From (iii) and (iv) we obtain

$26 \leq n(A \cup B \cup C) \leq 28$

Also $n(A \cup B \cup C)$ is a positive integer

$\therefore n(A \cup B \cup C) = 26$ or 27 or 28

141. (a) Let U be the set of consumers questioned X, the set of consumers who liked the product A and Y, the set of consumers who liked the product B. Then $n(U) = 1000$, $n(X) = 720$, $n(Y) = 450$

$n(X \cup Y) = n(X) + n(Y) - n(X \cap Y) = 1170 - n(X \cap Y)$

$\therefore n(X \cap Y) = 1170 - n(X \cup Y)$

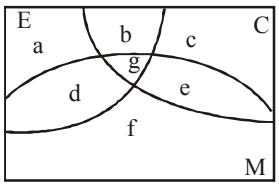
Clearly, $n(X \cap Y)$ is least when $n(X \cup Y)$ is maximum.

Now, $X \cup Y \subset U$

$\therefore n(X \cup Y) \leq n(U) = 1000$

$\therefore$ the maximum value of $n(X \cup Y)$ is 1000.

142. (b) C stands for set of students taking economics



$a + b + c + d + e + f + g = 40$; $a + b + d + g = 16$

$b + c + e + g = 22$; $d + e + f + g = 26$

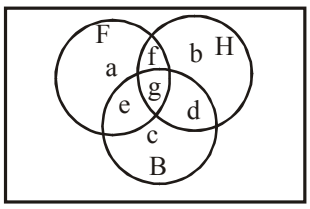
$b + g = 5$; $e + g = 14$; $g = 2$

Go by backward substitution

$e = 12$, $b = 3$, $d + f = 12$, $c + e = 17 \Rightarrow c = 5$; $a + d = 11$

$a + d + f = 18 \Rightarrow f = 7$ $\therefore d = 12 - 7 = 5$

143. (a)



$a + e + f + g = 285$, $b + d + f + g = 195$

$c + d + e + f = 115$, $e + g = 45$, $f + g = 70$, $d + g = 50$

$a + b + c + d + e + f + g = 500 - 50 = 450$

As in previous question, we obtain

$a + f = 240$, $b + d = 125$, $c + e = 65$

$a + e = 215$, $b + f = 145$; $b + c + d = 165$

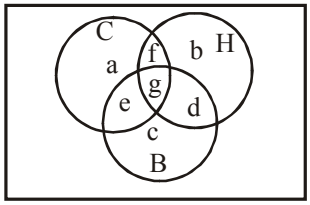
$a + c + e = 255$; $a + b + f = 335$

Solving we get

$b = 95$, $c = 40$, $a = 190$, $d = 30$, $e = 25$, $f = 50$ and $g = 20$

Desired quantity $= a + b + c = 325$

144. (d) $a + e + f + g = 224$



$b + d + f + g = 240$

$c + d + e + g = 336$

$d + g = 64$, $e + g = 80$

$f + g = 40$, $g = 24$

$\Rightarrow d = 40$

$e = 56$, $f = 16$

$a = 128$, $b = 160$, $c = 216$

$\therefore$ Boys who did not play any game

$= 800 - (a + b + c + d + e + f + g) = 160$

145. (b) Let $A = \{1\}$, $B = \{\{1\}, 2\}$ and $C = \{\{1\}, 2, 3\}$.

Here, $A \in B$ as $A = \{1\}$ and $B \subset C$ but $A \not\subset C$ as $1 \in A$ but $1 \notin C$.

146. (c) $V = \{a, e, i, o, u\}$

$V - B = \{e, o\}$

i.e., e and o are the elements belong to V but not to B

$B - V = \{k\}$

i.e., k is the element belongs to B but not to V.

$\therefore$ $B = \{a, i, u, k\}$

147. (b) Let M be the set of students passing in Mathematics, P be the set of students passing in Physics and C be the set of students passing in Chemistry.

Now, $n(M \cup P \cup C) = 50$, $n(M) = 37$, $n(P) = 24$, $n(C) = 43$

$n(M \cap P) \leq 19$, $n(M \cap C) \leq 29$, $n(P \cap C) \leq 20$ [given]

$n(M \cup P \cup C) = n(M) + n(P) + n(C) - n(M \cap P) - n(M \cap C) - n(P \cap C) + n(M \cap P \cap C) \leq 50$

$\Rightarrow 37 + 24 + 43 - 19 - 29 - 20 + n(M \cap P \cap C) \leq 50$

$\Rightarrow n(M \cap P \cap C) \leq 50 - 36$

$\Rightarrow n(M \cap P \cap C) \leq 14$

Thus, the largest possible number that could have passed all the three examinations, is 14.