e.g., (ii) *If there are three sets* A, B, C *and* $a \in A$, $b \in B$, $c \in C$, *then we form an ordered triplet* (a, b, c).

The set of all ordered triplets (a, b, c) is called the cartesian product of these sets A, B and C.

i.e., $A \times B \times C = \{(a, b, c) : a \in A, b \in B, c \in C\}$

(vi) If A and B are non-empty subsets, then

$$A \times B = B \times A \Leftrightarrow A = B.$$

(vii) If A and B are two non-empty sets having n elements in common, then $A \times B$ and $B \times A$ have n^2 elements in common.

Exercise

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. Which of the following is the empty set?
(a) $\{x : x$ is a real number and $x^2 - 1 = 0\}$
(b) $\{x : x$ is a real number and $x^2 + 1 = 0\}$
(c) $\{x : x$ is a real number and $x^2 - 9 = 0\}$
(d) $\{x : x$ is a real number and $x^2 = x + 2\}$

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

4. If a set A has n elements, then the total number of subsets of A is
(a) n (b) n^2
(c) 2^n (d) $2n$

5. The number of proper subsets of the set $\{1, 2, 3\}$ is
(a) 8 (b) 7
(c) 6 (d) 5

6. Given the sets $A = \{1, 2, 3\}$, $B = \{3, 4\}$, $C = \{4, 5, 6\}$, then $A \cup (B \cap C)$ is
(a) $\{3\}$ (b) $\{1, 2, 3, 4\}$
(c) $\{1, 2, 4, 5\}$ (d) $\{1, 2, 3, 4, 5, 6\}$

7. If the sets A and B are defined as

$$A = \left\{(x, y) : y = \frac{1}{x},\ 0 \neq x \in R\right\}$$

$$B = \{(x, y) : y = -x,\ x \in R\}$$

then
(a) $A \cap B = A$ (b) $A \cap B = B$
(c) $A \cap B = \phi$ (d) None of these

8. Let $A = [x : x \in R, |x| < 1]$; $B = [x : x \in R, |x - 1| \geq 1]$ and $A \cup B = R - D$, then the set D is
(a) $[x : 1 < x \leq 2]$ (b) $[x : 1 \leq x < 2]$
(c) $[x : 1 \leq x \leq 2]$ (d) None of these

9. If the sets A and B are defined as

$A = \{(x, y) : y = e^x, x \in R\}$; $B = \{(x, y) : y = x, x \in R\}$, then
(a) $B \subseteq A$ (b) $A \subseteq B$
(c) $A \cap B = \phi$ (d) $A \cup B = A$

10. Let $n(U) = 700$, $n(A) = 200$, $n(B) = 300$ and $n(A \cap B) = 100$, then $n(A^c \cap B^c)$ is equal to
(a) 400 (b) 600
(c) 300 (d) 200

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

(a) 3100 (b) 3300
(c) 2900 (d) 1400

12. In a city 20% of the population travels by car, 50% travels by bus and 10% travels by both car and bus. Then, persons travelling by car or bus is

(a) 80% (b) 40%
(c) 60% (d) 70%

13. In a class of 55 students, the number of students studying different subjects are 23 in Mathematics, 24 in Physics, 19 in Chemistry, 12 in Mathematics and Physics, 9 in Mathematics and Chemistry, 7 in Physics and Chemistry and 4 in all the three subjects. The number of students who have taken exactly one subject is

(a) 6 (b) 9
(c) 7 (d) All of these

14. If A, B and C are any three sets, then $A \times (B \cup C)$ is equal to

(a) $(A \times B) \cup (A \times C)$ (b) $(A \cup B) \times (A \cup C)$
(c) $(A \times B) \cap (A \times C)$ (d) None of these

15. If A, B and C are any three sets, then $A - (B \cup C)$ is equal to

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

16. If A, B and C are non-empty sets, then $(A - B) \cup (B - A)$ equals

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

17. If $A = \{2,4,5\}$, $B = \{7, 8,9\}$, then $n(A \times B)$ is equal to

(a) 6 (b) 9
(c) 3 (d) 0

18. If the set A has p elements, B has q elements, then the number of elements in $A \times B$ is

(a) $p+q$ (b) $p+q+1$
(c) pq (d) p^2

19. If $A = \{a,b\}, B = \{c,d\}, C = \{d,e\}$, then $\{(a,c),(a,d),(a,e),(b,c),(b,d),(b,e)\}$ is equal to

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

20. If P, Q and R are subsets of a set A, then $R \times (P^c \cup Q^c)^c$ is equal to

(a) $(R \times P) \cap (R \times Q)$ (b) $(R \times Q) \cap (R \times P)$
(c) $(R \times P) \cup (R \times Q)$ (d) None of these

21. In rule method the null set is represented by

(a) $\{\}$ (b) ϕ
(c) $\{x : x = x\}$, (d) $\{x : x \neq x\}$

22. $A = \{x : x \neq x\}$ represents

(a) $\{0\}$ (b) $\{\}$
(c) $\{1\}$ (d) $\{x\}$

23. If $Q = \left\{x : x = \frac{1}{y}, \text{where } y \in N\right\}$, then

(a) $0 \in Q$ (b) $1 \in Q$
(c) $2 \in Q$ (d) $\frac{2}{3} \in Q$

24. Which set is the subset of all given sets?

(a) $\{1, 2, 3, 4,...\}$ (b) $\{1\}$
(c) $\{0\}$ (d) $\{\}$

25. Let $S = \{0,1,5,4,7\}$. Then, the total number of subsets of S is

(a) 64 (b) 32
(c) 40 (d) 20

26. The number of non-empty subsets of the set $\{1, 2, 3, 4\}$ is

(a) 15 (b) 14
(c) 16 (d) 17

27. 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

28. If $A \cap B = B$, then

(a) $A \subset B$ (b) $B \subset A$
(c) $A = \phi$ (d) $B = \phi$

29. If A and B are two sets, then $A \cup B = A \cap B$ iff

(a) $A \subseteq B$ (b) $B \subseteq A$
(c) $A = B$ (d) None of these

30. Let A and B be two sets. Then,

(a) $A \cup B \subseteq A \cap B$ (b) $A \cap B \subseteq A \cup B$
(c) $A \cap B = A \cup B$ (d). None of these

31. Let $A = \{(x, y) : y = e^x, x \in R\}$, $B = \{(x, y) : y = e^{-x}, x \in R\}$. Then,

(a) $A \cap B = \phi$ (b) $A \cap B \neq \phi$
(c) $A \cup B = R^2$ (d) None of these

32. If $A = \{2, 3, 4, 8, 10\}, B = \{3, 4, 5, 10, 12\}$, $C = \{4, 5, 6, 12, 14\}$, then $(A \cap B) \cup (A \cap C)$ is equal to

(a) $\{3, 4, 10\}$ (b) $\{2, 8, 10\}$
(c) $\{4, 5, 6\}$ (d) $\{3, 5, 14\}$

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

(a) A (b) B
(c) A^c (d) B^c

34. If A, B, C be three sets such that $A \cup B = A \cup C$ and $A \cap B = A \cap C$, then

(a) $A = B$ (b) $B = C$
(c) $A = C$ (d) $A = B = C$

35. Let $A = \{a, b, c\}, B = \{b, c, d\}, C = \{a, b, d, e\}$, then $A \cap (B \cup C)$ is

(a) $\{a, b, c\}$ (b) $\{b, c, d\}$
(c) $\{a, b, d, e\}$ (d) $\{e\}$

36. If A and B are sets, then $A \cap (B - A)$ is

(a) ϕ (b) A
(c) B (d) None of these

37. 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

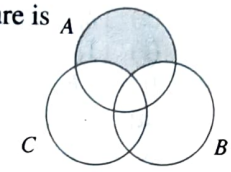
38. Let $U = \{1,2,3,4,5,6,7,8,9,10\}$, $A = \{1,2,5\}, B = \{6,7\}$, then $A \cap B'$ is
(a) B' (b) A
(c) A' (d) B

39. If A is any set, then
(a) $A \cup A' = \phi$ (b) $A \cup A' = U$
(c) $A \cap A' = U$ (d) None of these

40. If $N_a = \{an : n \in N\}$, then $N_5 \cap N_7$ is equal to
(a) N_7 (b) N
(c) N_{35} (d) N_5
(e) N_{12}

41. If $aN = \{ax : x \in N\}$, then the set $3N \cap 7N$ is
(a) $21N$ (b) $10N$
(c) $4N$ (d) None of these

42. 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) $A - (B \cup C)$

43. If A and B are two sets, then $(A - B) \cup (B - A) \cup (A \cap B)$ is equal to
(a) $A \cup B$ (b) $A \cap B$
(c) A (d) B'

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

45. 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
(a) $A \cup B \cup C$ (b) $A \cup (B \cap C)$
(c) $A \cap B \cap C$ (d) $A \cap (B \cup C)$

46. 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

47. Let A and B be two sets such that
$n(A) = 0.16$, $n(B) = 0.14$, $n(A \cup B) = 0.25$
Then, $n(A \cap B)$ is equal to
(a) 0.3 (b) 0.5
(c) 0.05 (d) None of these

48. If A and B are disjoint, then $n(A \cup B)$ is equal to
(a) $n(A)$ (b) $n(B)$
(c) $n(A) + n(B)$ (d) $n(A) \cdot n(B)$

49. If A and B are not disjoint sets, then $n(A \cup B)$ is equal to
(a) $n(A) + n(B)$
(b) $n(A) + n(B) - n(A \cap B)$
(c) $n(A) + n(B) + n(A \cap B)$
(d) $n(A)n(B)$
(e) $n(A) - n(B)$

50. 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

51. 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

52. 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) $39 \le x \le 63$ (d) None of these

53. 20 teachers of a school either teach Mathematics or Physics. 12 of them teach Mathematics while 4 teach both the subjects. Then, the number of teachers teaching Physics only is
(a) 12 (b) 8
(c) 16 (d) None of these

54. Of the members of three Athletic teams in a school 21 are in the cricket team, 26 are in the hockey team and 29 are in the football team. Among them, 14 play hockey and cricket, 15 play hockey and football and 12 play football and cricket. Eight play all the three games. The total number of members in the three Athletic teams is
(a) 43 (b) 76
(c) 49 (d) None of these

55. In a class of 100 students, 55 students have passed in Mathematics and 67 students have passed in Physics. Then, the number of students who have passed in Physics only is
(a) 22 (b) 33
(c) 10 (d) 45

56. If A and B are two sets, then $A \times B = B \times A$ iff
(a) $A \subseteq B$ (b) $B \subseteq A$
(c) $A = B$ (d) None of these

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

58. Let A and B be subsets of a set X. Then,
(a) $A - B = A \cup B$ (b) $A - B = A \cap B$
(c) $A - B = A^c \cap B$ (d) $A - B = A \cap B^c$