1. Which of the following sets are null sets?
A. \{ \}  
B. \ø 
C. Both (a) and (b)  
D. \{0\}  
Answer: C

2. Let R be a non-empty relation on a collection of sets defined by ARB if and only if A \cap B = \ø Then (pick the TRUE statement)
A. R is reflexive and transitive 
B. R is an equivalence relation 
C. R is symmetric and not transitive 
D. R is not reflexive and not symmetric 
Answer: C

3. The binary relation S = \Ø (empty set) on set A = \{1, 2,3\} is 
A. transitive and reflexive 
B. symmetric and reflexive 
C. transitive and symmetric 
D. neither reflexive nor symmetric 
Answer: C

4. Number of subsets of a set of order three is 
A. 2 
B. 4 
C. 6 
D. 8 
Answer: D

5. "n/m" means that n is a factor of m, then the relation T is 
A. reflexive, transitive and not symmetric 
B. reflexive, transitive and symmetric 
C. transitive and symmetric 
D. reflexive and symmetric 
Answer: A

6. If R be a symmetric and transitive relation on a set A, then 
A. R is not reflexive and hence not an equivalence relation 
B. R is reflexive and hence an equivalence relation 

C. R is reflexive and hence a partial order  
D. None of these  
Answer: D  

7. Let P(S) denote the power set of set S. Which of the following is always TRUE ?  
A. S \notin P(S)  
B. P(P(S)) = P(S)  
C. P(S) \cap S = P(S)  
D. P(S) \cap P(P(S)) = \{ \emptyset \}  
Answer: D  

8. The number of elements in the Power set P(S) of the set S = \{ \emptyset, 1, [2, 3] \} is  
A. 2  
B. 4  
C. 6  
D. 8  
Answer: D  

9. If A and B are sets and A \cup B = A \cap B, then  
A. A = B  
B. A = \emptyset  
C. B = \emptyset  
D. none of these  
Answer: A  

10. Let S be an infinite set and S1, S2, S3, ..., Sn be sets such that S1 \cup S2 \cup S3 \cup .......Sn = S then  
A. atleast one of the sets Si is a finite set  
B. atleast one of the sets Si is an infinite set  
C. not more than one of the set Si can be infinite  
D. none of these  
Answer: B  

11. If X and Y are two sets, then X \cap (Y \cup X) C equals  
A. \emptyset  
B. X  
C. Y  
D. None of these  
Answer: A
12. If \( f : X \rightarrow Y \) and \( a, b \subseteq X \), then \( f(a \cap b) \) is equal to
   \[ 
   \text{A. } f(a) - f(b) \\
   \text{B. } f(a) \cap f(b) \\
   \text{C. } f(b) - f(a) \\
   \text{D. } \text{a proper subset of } f(a) \cap f(b) 
   \]
   Answer: D

13. Let \( f : R \rightarrow R \) be defined by \( f(x) = \begin{cases} x+2 & (x \leq -1) \\ x^2 & (-1 \leq x \leq 1) \\ 2 - x & (x \geq 1) \end{cases} \) Then value of \( f(-1.75) + f(0.5) + f(1.5) \) is
   \[ 
   \text{A. } 0 \\
   \text{B. } 1 \\
   \text{C. } 2 \\
   \text{D. } \text{None of these} 
   \]
   Answer: B

14. A relation \( R \) is defined on the set of positive integers as \( xRy \) if \( 2x + y \leq 5 \). The relation \( R \) is
   \[ 
   \text{A. } \text{reflexive} \\
   \text{B. } \text{transitive} \\
   \text{C. } \text{symmetric} \\
   \text{D. } \text{None of these} 
   \]
   Answer: B

15. Let \( R \) be a relation on the set \( \{1,2,3,4,5,6\} \) given by \( \{(1,1),(1,5),(2,2),(2,3),(2,6),(3,2),(3,3),(3,6),(4,4),(5,5),(6,2),(6,6),(6,6)\} \). The partition included by \( R \) is
   \[ 
   \text{A. } \{1,2,3,4,5,6\} \\
   \text{B. } \{\{1,3,5,6\},\{2,4\}\} \\
   \text{C. } \{\{1,2,3,4\},\{5,6\}\} \\
   \text{D. } \{\{1,5\},\{2,3,6\},\{4\}\} 
   \]
   Answer: D

16. Which of the following sets is a null set? I. \( X = \{x \mid x = 9, 2x = 4\} \) II. \( Y = \{x \mid x = 2x, x \neq 0\} \) III. \( Z = \{x \mid x-8 = 4\} \)
   \[ 
   \text{A. } \text{I and II only} \\
   \text{B. } \text{I, II and III} \\
   \text{C. } \text{I and III only} \\
   \text{D. } \text{II and III only} 
   \]
   Answer: A
17. A Relation R is defined on the set of integers as xRy if (x + y) is even. Which of the following statements is TRUE?
A. R is an equivalence relation having three equivalence classes
B. R is an equivalence relation having two equivalence classes
C. R is an equivalence relation having one equivalence class
D. R is not an equivalence relation
Answer: B

18. The number of elements in the power set of the set \{ \{a, b\}, c\} is
A. 2
B. 4
C. 6
D. 8
Answer: B

19. If R = ((1, 1), (3, 1), (2, 3), (4, 2)), then which of the following represents R2, where R2 is R composite R?
A. ((1, 1), (2, 1), (4, 3), (3, 1))
B. ((1, 1), (3, 1), (2, 3), (4, 2))
C. 1(1, 3), (3, 3), (3, 4), (3, 2))
D. f(1, 1), (9, 1), (4, 9), (16, 4))
Answer: A

20. If f : R ---->R defined by f(x) = x^2 + 1, then values of f^-1(17) and f^-1(-3) are respectively
A. {4, -4}, Ø
B. Ø, {3, -3}
C. {3, -3}, {Ø}
D. {Ø}, (4, - 4)
Answer: A

21. If every element of a group G is its own inverse, then G is
A. abelian
B. cyclic
C. finite
D. infinite
Answer: A
22. The universal relation $A \times A$ on $A$ is
A. anti-symmetric  B. an equivalence relation  C. a partial ordering relation  D. not symmetric and not anti-symmetric
Answer: B

23. Total number of different partitions of a set having four elements is
A. 5  B. 10  C. 15  D. 20
Answer: C

24. A partition of $\{1, 2, 3, 4, 5\}$ is the family
A. $\{(1, 2, 3),(5)\}$  B. $\{(1, 2,), (3, 4, 5)\}$
C. $\varnothing(1, 2),(3, 4),(5)$  D. $\{(1, 2),(3, 4),(3, 5)\}$
Answer: B

25. Let $s(w)$ denote the set of all the letters in $w$ where $w$ is an English word. Let us denote set equality, subset and union relations by $=$, $\subset$ and $\cup$ respectively. Which of the following is NOT true?
A. $s(ten) \subset s(twenty)$  B. $s(stored) = s(sorted)$
C. $s(sixty) \subset s(six) \cup s(twenty)$  D. None of these
Answer: D

26. In a beauty contest, half the number of experts voted for Mr. A and two thirds voted for Mr. B. 10 voted for both and 6 did not vote for either. How many experts were there in all ?
A. 18  B. 24  C. 36  D. 44
Answer: B

27. Let $n(A)$ denotes the number of elements in set $A$. If $n(A) = p$ and $n(B) = q$, then how many ordered pairs $(a, b)$ are there with $a \in A$ and $b \in B$ ?
A. \( p \times q \)  
B. \( p + q \)  
C. \( 2 \ pq \)  
D. \( 4 \ pq \)

Answer: A

28. The set of all Equivalence classes of a set \( A \) of cardinality \( C \)
A. forms a partition of \( A \)  
B. is of cardinality \( 2C \)  
C. has the same cardinality as \( A \)  
D. none of these

Answer: A

29. Let \( Z \) denote the set of all integers. Define \( f : Z \rightarrow Z \) by \( f(x) = \begin{cases} x/2 & (x \text{ is even}) \\ 0 & (x \text{ is odd}) \end{cases} \) then \( f \) is
A. one-one and onto  
B. one-one but not onto  
C. onto but not one-one  
D. neither one-one nor-onto

Answer: C

30. Let \( R \) be a relation "\( (x - y) \) is divisible by \( m \)\), where \( x, y, m \) are integers and \( m > 1 \), then \( R \) is
A. partial order  
B. equivalence relation  
C. symmetric but not transitive  
D. anti symmetric and not transitive

Answer: B

31. A subset \( H \) of a group \((G,*)\) is a group if
A. \( a, b \in H \Rightarrow a \ast b \in H \)  
B. \( a \in H \Rightarrow a^{-1} \in H \)  
C. \( a, b \in H \Rightarrow a \ast b^{-1} \in H \)  
D. \( H \) contains the identity element

Answer: C

32. If \( A = \{1, 2, 3\} \) then relation \( S = \{(1, 1), (2, 2)\} \) is
A. symmetric only  
B. anti-symmetric only  
C. an equivalence relation  
D. both symmetric and anti-symmetric
33. Which of the following statements is true?
A. Empty relation $\varnothing$ is reflexive
B. Every equivalence relation is a partial-ordering relation.
C. Number of relations form $A = \{x, y, z\}$ to $B = \{1, 2\}$ is 64.
D. Properties of a relation being symmetric and being ant-symmetric are negative of each other.

Answer: C

34. Let $A = \{1, 2, \ldots, 3\}$ Define $\sim$ by $x \sim y \iff x$ divides $y$. Then $\sim$ is
A. symmetric
B. an equivalence relation
C. a partial-ordering relation
D. reflexive, but not a partial-ordering

Answer: C

35. $G(e, a, b, c}$ is an abelian group with ‘$e$’ as identity element. The order of the other elements are
A. 2, 2, 4
B. 2, 2, 3
C. 2, 3, 4
D. 3, 3, 3

Answer: B

36. If $f : A \rightarrow B$ is a bijective function, then $f^{-1}$ of $f =$
A. $f$
B. $f^{-1}$
C. $f \circ f^{-1}$
D. $IA$(Identity map of the set $A$)

Answer: D

37. The set of all real numbers under the usual multiplication operation is not a group since
A. zero has no inverse
B. identity element does not exist
C. multiplication is not associative
D. multiplication is not a binary operation

Answer: A
38. If \((G, \cdot)\) is a group such that \((ab)^{-1} = b^{-1} a^{-1}\), \(\forall a, b \in G\), then \(G\) is a/an
A. abelian group  
B. non-abelian group  
C. commutative semi group  
D. None of these
Answer: A

39. If \(*\) is defined on \(R^*\) as \(a * b = \frac{ab}{2}\) then identity element in the group \((R^*, *)\) is
A. 1  
B. 2  
C. 1/2  
D. 1/3
Answer: B

40. If \((G, .)\) is a group such that \(a^2 = e, \forall a \in G\), then \(G\) is
A. semi group  
B. abelian group  
C. non-abelian group  
D. none of these
Answer: B

41. Some group \((G, 0)\) is known to be abelian. Then which one of the following is TRUE for \(G\) ?
A. \(g = g^{-1}\) for every \(g \in G\)  
B. \(g = g^2\) for every \(g \in G\)  
C. \((g o h)^2 = g^2 o h^2\) for every \(g, h \in G\)  
D. \(G\) is of finite order
Answer: C

42. If the binary operation \(*\) is defined on a set of ordered pairs of real numbers as \((a, b) * (c, d) = (ad + bc, bd)\) and is associative, then \((1, 2) * (3, 5) * (3, 4)\) equals
A. (7,11)  
B. (23,11)  
C. (32,40)  
D. (74,40)
Answer: D

43. If \(A = (1, 2, 3, 4)\). Let \(\sim = ((1, 2), (1, 3), (4, 2)\). Then \(\sim\) is
A. reflexive  
B. transitive  
C. symmetric  
D. not anti-symmetric
Answer: B

44. Which of the following statements is false?
A. If R is reflexive, then \( R \cap R^{-1} \neq \emptyset \)
B. \( R \cap R^{-1} \neq \emptyset \Rightarrow R \) is anti-symmetric.
C. If R, R' are reflexive relations in A, then R - R' is reflexive
D. If R, R' are equivalence relations in a set A, then R \( \cap R' \) is also an equivalence relation in A.

Answer: C

45. If \( R = \{(1, 2),(2, 3),(3, 3)\} \) be a relation defined on \( A = \{1, 2, 3\} \) then \( R \cdot R \) (\( = R^2 \)) is
A. R itself
B. \( \{(1, 2),(1, 3),(3, 3)\} \)
C. \( \{(1, 3),(2, 3),(3, 3)\} \)
D. \( \{(2, 1),(1, 3),(2, 3)\} \)

Answer: C

46. Every set is a ________ of itself
A. Compliment
B. Proper subset
C. Improper subset
D. None of the above

Answer: C

47. Empty set is a ?
A. Infinite Set
B. Invalid Set
C. Finite Set
D. None of the above

Answer: C

48. \( A' \) will contain how many elements from the original set A
A. 0
B. 1
C. Infinite
D. All elements in A

Answer: A
49. A — B will contain elements in ?
A. A not in B   B. B not in A
C. Both A and B   D. Neither A nor B
Answer: A

50. A set has n elements, then the, number of elements in its power set is ?
A. 2n   B. m x n
C. m + n   D. m - n
Answer: B

51. The intersection of sets A and B is expressed as ?
A. AxB   B. AnB
C. A-B   D. A/B
Answer: B

52. If R = {(1,1),(2,3),(4,5)}, then domain of the function is ?
A. Range R = {2,3,4,5}   B. Range R {1,1,4,5}
C. Range R = {1,3,5}   D. Range R {1,2,5}
Answer: C

53. How many rational and irrational numbers are possible between 0 and 1 ?
A. 0   B. Finite
C. Infinite   D. 1
Answer: C

54. In 4th quadrant ?
A. X < 0, Y > 0   B. X > 0, Y < 0
C. X > 0, Y > 0   D. X < 0, Y < 0

55. In 2nd quadrant?
A. $X < 0, Y > 0$  
B. $X > 0, Y > 0$  
C. $X > 0, Y < 0$  
D. $X < 0, Y < 0$

Answer: A

56. $A - B$ is read as?
A. Difference of $B$ and $A$  
B. Difference of $A$ and $B$  
C. Both $a$ and $b$  
D. None of the above

Answer: B

57. If $A = \{5, 6, 7\}$ and $B = \{7, 8, 9\}$ then $A \cup B$ is equal to:
A. $\{5, 6, 7\}$  
B. $\{7, 8, 9\}$  
C. $\{5, 6, 7, 8, 9\}$  
D. None of these

Answer: C

58. In 3rd quadrant?
A. $X < 0, Y > 0$  
B. $X > 0, Y < 0$  
C. $X < 0, Y > 0$  
D. $X < 0, Y > 0$

Answer: D

59. If $A$ is not equal to $B$, then the Cartesian product?
A. $A \times B$ not equal to $B \times A$  
B. $A \times B = B \times A$  
C. is not possible  
D. None of the above

Answer: A
60. If \( A = \{0,2\} \) and \( B = \{1,3\} \), then Cartesian product?
A. \( A \times B \neq B \times A \)  
B. \( A \times B = B \times A \)  
C. is not possible  
D. None of the above

Answer: A

61. \( A \subseteq B \) is read as?
A. \( A \) is a subset of \( B \)  
B. \( B \) is a subset of \( A \)  
C. \( A \) is less than \( B \)  
D. \( A \) is a proper subset of \( B \)

Answer: D

62. If \( R = \{(1,1),(2,3),(4,5)\} \), then domain of the function is?
A. \( \text{Dom} \ R \{1,3,5\} \)  
B. \( \text{Dom} \ R \{1,2,4\} \)  
C. \( \text{Dom} \ R \{1,1,4,5\} \)  
D. \( \text{Dom} \ R \{2,3,4,5\} \)

Answer: A

63. In 1st quadrant?
A. \( X < 0, Y > 0 \)  
B. \( X > 0, Y < 0 \)  
C. \( X > 0, Y > 0 \)  
D. \( X < 0, Y < 0 \)

Answer: C

64. The union of sets \( A \) and \( B \) is expressed as?
A. \( A/B \)  
B. \( A \cup B \)  
C. \( A \times B \)  
D. \( A - B \)

Answer: B

65. \((A')' = ? \)
A. \( A \)  
B. \( U \)  
C. \( A' \)  
D. \( U - A \)

Answer: D
66. The set of intelligent students in a class is.
A. A null set  
B. A finite set  
C. A singleton set  
D. Not a well defined collection
Answer: D

67. If A is any set, then
A. $A \cap A' = U$  
B. $A \cup A' = U$  
C. $A \cup A' = \emptyset$  
D. None of these
Answer: A

68. If the set has p elements, b has q elements, the no of elements in A x B is
A. $p^2$  
B. $pq$  
C. $p + q$  
D. $p + q + 1$
Answer: B

69. A survey showed that 63 % of the Americans like cheese whereas 76 % like apples. If x % of Americans like both cheese and apples, then find the range of x?
A. $0 \leq x \leq 23 \%$  
B. $4 \leq x \leq 35 \%$  
C. $0 \leq x \leq 39 \%$  
D. $6 \leq x \leq 33 \%$
Answer: C

70. 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. $B^c$
Answer: A

71. The smallest set A such that $A \cup \{1, 2\} = \{1, 2, 3, 5, 9\}$ is
72. If A, B and C are any three sets, then \( A - (B \cup C) \) is equal to
A. \( (A - B) \cup C \)
B. \( (A - B) \cap C \)
C. \( (A - B) \cap (A - C) \)
D. \( (A - B) \cup (A - C) \)
Answer: C

73. 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. \( B^c \)
Answer: A

74. Two finite sets have \( n \) and \( m \) elements. The number of elements in the power set of first set is 48 more than the total number of elements in power set of the second set. Then the values of \( m \) and \( n \) are
A. 6, 3
B. 7, 6
C. 6, 4
D. 7, 4
Answer: C

75. The number of proper subsets of the set \( \{1, 2, 3\} \) is.
A. 5
B. 6
C. 7
D. 8
Answer: B

76. If \( A \cap B = B \), then.
A. \( A = \emptyset \)
B. \( B = \emptyset \)
C. \( A \subset B \)
D. \( B \subset A \)
77. If \( x \neq 1 \), and \( f(x) = x + 1 / x - 1 \) is a real function, then \( f(f(f(2))) \) is
A. 1  
B. 2  
C. 3  
D. 4  

Answer: C

78. In a set - builder method, the null set is represented by
A. \( \Phi \)  
B. \{ \}  
C. \{ x : x = x \}  
D. \{ x : x \neq x \}  

Answer: D

79. \( A = \{ x : x \neq x \} \) represents
A. \{ \}  
B. \{0\}  
C. \{1\}  
D. \{x\}  

Answer: A

80. If \( A, B \) and \( C \) are any three sets, then \( A \times (B \cup C) \) is equal to.
A. \( (A \cup B) \times (A \cup C) \)  
B. \( (A \times B) \cap (A \times C) \)  
C. \( (A \times B) \cup (A \times C) \)  
D. None of these  

Answer: C

81. A set consisting of a definite number of elements is called a 
A. Finite set  
B. Null set  
C. Infinite set  
D. Singleton set  

Answer: A
82. If A, B, C be three sets such that A ∪ B = A ∪ C and A ∩ B = A ∩ C, then.

A. A = B  
B. A = C  
C. B = C  
D. A = B = C  

Answer: C

83. If A = {1, 2, 5} and B = {3, 4, 5, 9}, then A ∩ B is equal to  
If A = {x: x = 3n, n \in N} and B = {x: x = 9n, n \in N}, then which of the following is false?

A. A ∩ B = {9, 81, 729, 6561}  
B. A ∪ B = {3, 9, 27, 81, 243, 729, 6561}  
C. A-B = {3, 27, 243}  
D. none of these  

Answer: A

84. If A = {x \in C: x^2 = 1} and B = {x \in C: x^4 = 1}, then A ∩ B is equal to

A. {-i, i}  
B. {1, 1}  
C. {-1, 1, i, -i}  
D. none of these  

Answer: A

85. If A and B are two sets containing respectively m and n distinct elements. How many different relations can be defined for A and B?

A. 2^{m-n}  
B. 2^{m/n}  
C. 2^{mn}  
D. 2^{m+n}  

Answer: C

86. \{(a, b): a^2 + b^2 = 1\} on the set S has the following relation

A. reflexive  
B. symmetric  
C. reflexive and transitive  
D. none  

Answer: B

87. If Y is the smallest set such that Y ∪ \{1, 2\} = \{1, 2, 3, 5, 9\}, then Y is equal to
88. If R is the relation “is greater than” from A =\{1,2,3,4,5\} to B=\{1,3,4\}, Than R-1 is
A. \{(3,4),(4,5),(3,5)\}  
B. \{(1,2),(1,3),(1,4),(1,5)\}  
C. \{(1,2), (1,3), (1,4), (3,4), (1,5), (3,5), (4,5)\}  
D. \{(2,1), (3,1), (4,1), (4,3), (5,1), (5,3), (5,4)\}  
Answer: C

89. If R is a relation on a finite set having a elements , then the number of relations on A is
A. \(a^2\)  
B. \(a^a\)  
C. \(2a\)  
D. \(2a^2\)  
Answer: D

90. If R is a relation on a finite set having a elements , then the number of relations on A is
A. \(a^2\)  
B. \(a^a\)  
C. \(2a\)  
D. \(2a^2\)  
Answer: D

91. Let R= \{(x,y) : x, y belong to N, 2x+y =41\}. The range is of the relation R is
A. \{2n: n belongs to N, 1< n< 20\}  
B. \{(2n+2) : n belongs to N, 1< n <20\}  
C. \{(2n +1):n belongs to N , 1≤ n≤ 20\}  
D. \{(2n-1) : n belongs to N, 1≤ n≤ 20\}  
Answer: D

92. If A = \{1, 2, 5\} and B = \{3, 4, 5, 9\}, then A ? B is equal to
A. \{1, 2, 5, 9\}  
B. \{1, 2, 3, 4, 5, 9\}  
C. \{1, 2, 3, 4, 9\}  
D. none of these  
Answer: C
93. If \( n(A) = 115 \), \( n(B) = 326 \), \( n(A-B) = 47 \), then \( n(A U B) \) is equal to
A. 165  
B. 370  
C. 373  
D. 422  
Answer: C

94. Solve \( f(x) = \sqrt{9-x^2} \) the range is
A. \( \{x: 3 \leq x \leq 0\} \)  
B. \( \{x: 0 \leq x \leq 3\} \)  
C. \( \{x: 0 < x < 3\} \)  
D. \( \{x: 3 < x < 0\} \)  
Answer: B

95. The range of the function \( f(x) = \left| x - 1 \right| \) is
A. \( \mathbb{R} \)  
B. \( [0, \infty) \)  
C. \( (0, - \infty) \)  
D. \( (- \infty, 0) \)  
Answer: B

96. If \( f(x) = \log \left(\frac{1 + x}{1 - x}\right) \), then \( f \left( \frac{2x}{1 + x^2} \right) \) is equal to
A. \( \{f(x)\}^2 \)  
B. \( \{f(x)\}^3 \)  
C. \( 2f(x) \)  
D. \( 3f(x) \)  
Answer: C

97. The range of the function \( f(x) = \frac{x}{\left|x\right|} \) is
A. \( \mathbb{R} - \{0\} \)  
B. \( \{-1, 1\} \)  
C. \( \mathbb{R} - \{-1, 1\} \)  
D. None of these  
Answer: B

98. A set is known by its ______.
A. Elements  
B. Members  
C. Letters  
D. Values
99. Let \( f = \{(x, x^2 / (1 + x^2)) : x \in \mathbb{R}\} \) be a function from \( \mathbb{R} \) into \( \mathbb{R} \). Range of \( x \) is
A. positive real numbers.
B. negative real numbers
C. non-negative real numbers
D. any positive real number \( x \) such that \( 0 \leq x < 1 \)

Answer: D

100. A set contains \( k \) elements. The power set of this set contains
A. \( k \) elements
B. \( 2^k \) elements
C. \( k^2 \) elements
D. \( 2^k \) elements

Answer: B