1). If a set has n elements, then its power set has

a) 2^n **elements** b) n^2 elements c) n^n elements d) 2 elements

2) What is the cardinality of $\{.\phi\}$ a) 0 **b) 1** c) ϕ d) $\{.\phi\}$

3) If $\overline{A \cup B} = \{a,b,c\}$ then $\overline{A} \cap \overline{B}$ = a) $\{\{a\},\{b\},\{c\}\}$ b) $\{a,\{b\},c\}$ **c)** $\{a,b,c\}$ d) $\{a,\{b,c\}\}$

4) The dual of the statement of $(A \cap B) \cup (\overline{A} \cap B) \cup (A \cap \overline{B}) \cup (\overline{A} \cap \overline{B}) = U$ is

a) $(A \cap B) \cap (\overline{A} \cap B) \cap (A \cap \overline{B}) \cap (\overline{A} \cap \overline{B}) = U$ **b)** $(A \cup B) \cap (\overline{A} \cup B) \cap (A \cup \overline{B}) \cap (\overline{A} \cup \overline{B}) = \phi$

c) $(A \cup B) \cup (\overline{A} \cup B) \cup (A \cup \overline{B}) \cup (\overline{A} \cup \overline{B}) = \phi$ d) $(A \cup B) \cap (\overline{A} \cup B) \cap (A \cup \overline{B}) \cap (\overline{A} \cup \overline{B}) \neq \phi$

5) Simplification of $(A \cap B) \cup (A \cap B \cap \overline{C} \cap D) \cup (\overline{A} \cap B) =$

a) A b) U c) ϕ **d) B**

6) The number of elements in a power set { ϕ } is a) 1 **b) 2** c) 0 d) 2^2

7) A subset R of the Cartesian product A x B i s called a

a) function **b) relation** c) set d) universal set

8) Which of the following is true?

a) $A \times B = B \times A$ **b)** $A \times B \neq B \times A$ c) $A \times B \cong B \times A$ d) $A \times B \leq B \times A$

9) If $A \times B = \phi$ then the sets A and B are

a) at least one set is empty set b) A $\neq \phi$ and B $\neq \phi$

c) A = universal set and B = { 1} d) A and B are singleton sets

10) If n(A) = 3 and n(B) = 4 then the total number of relations from A to B is a) 2^3 b) 2^2 **c)** $\mathbf{2^{12}}$ d) 2^0

11) The smallest relation on N is a) Identity relation **b) empty relation** c) universal relation d) NxN

12) A relation R on a set A is said to be anti-symmetric if

a) (a, b) and (b, a) $\in$ **R then a = b** b) (a, b) and (b, a) $\in$ R then a $\neq$ b

c) (a, b) and (b, a) $\notin$ R then a =b d) (a, b) and (b, a) $\notin$ R then a $\neq$ b

13) A relation R on a set A is called an equivalence relation, if

a) R is irreflexive, symmetric and transitive b) R is reflexive, antisymmetric and transitive

c) R is reflexive, symmetric and transitive d) R is irreflexive, antisymmetric and transitive

14) A relation R on a set A is called a partial order relation, if

a) R is irreflexive, symmetric and transitive **b) R is reflexive, antisymmetric and transitive**

c) R is reflexive, symmetric and transitive d) R is irreflexive, antisymmetric and transitive

15) The partition of the set { 1,2,3,4,5,6} is

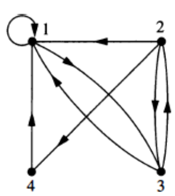
a) { {1,2,3},{4,5},{6}} b) { {1,2,5},{2,3,4},{6}} c) {{ϕ},{1,3,4},{5},{2,6}} d) {{1,2,3},{4,5}}

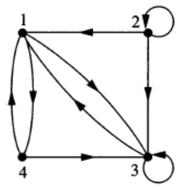
16) If R is a relation from a set A = {2,4,6,8} to the set B = { 3,5,7} and R is defined by

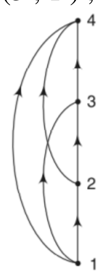
R = { (2,3),(2,5),(4,5),(4,7),(6,3),(6,70,(8,7)}then the matrix $M_{R^{-1}}$ =

a) $\begin{pmatrix} 1 & 0 & 1 & 0 \\ 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 \end{pmatrix}$ **b)** $\begin{pmatrix} 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 \end{pmatrix}$ c) $\begin{pmatrix} 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 \end{pmatrix}$ d) $\begin{pmatrix} 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 \end{pmatrix}$

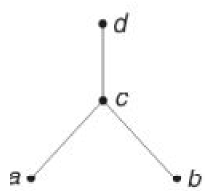
17). The directed graph of the relation
R = { (1 , 1) , (1 , 3), (2 , 1), (2, 3), (2 , 4) , (3 , 1) , (3 , 2), (4 , I) } on the set { I , 2 , 3 , 4 } is

a) 

b) 

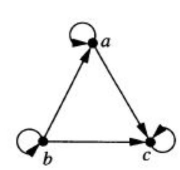
c) 

d) 

18) In the Hasse diagram 

the maximal element is

a) c b) a and b **c) d** d) b , c

19) list the ordered pairs in the relations represented by the directed graph 

a) {(a,b),(a,c) ,(b,c),(c,a)} b) {(a,a),(a,b),(a,c) ,(b,c),(c,a)}

c) {(a,a),(a,c),(b,a),(b,b) ,(b,c),(c,c)} d) {(a,b),(a,c) ,(b,c),(c,a)}

20) Let R be the relation on the set A = {0, 1 , 2, 3 } containing the ordered pairs (0, 1), (I , I), (1 , 2), (2, 0),(2 , 2), and (3 , 0).The reflexive closure of R is

a) $R \cap \Delta$, where $\Delta = \{(a,a)/a \notin A\}$ **b)** $R \cup \Delta$**, where** $\Delta = \{(a,a)/a \in A\}$

c). $R \cup \Delta$, where $\Delta = \{(a,a)/a \notin A\}$ d) $R \cap \Delta$, where $\Delta = \{(a,a)/a \in A\}$

21). The upper and lower bounds of a subset of a poset are not necessarily

a) equal **b) uniqe** c) different d) undefined

22) The LUB and GLB of a subset of a poset, if they exist, are

a) equal **b) uniqe** c) different d) undefined

23) The relation R on the set of integers defined by $|a-b| = 1$ is

a) reflexive **b) symmetric** c) antisymmetric c) transitive

24) The relation R which is both equivalence and partial order relation is

a) empty relation b) void relation **c) Identity relation** d) Reflexive relation

25) If R is the relation on the set of integers such that (a, b) ε R if and only if $b = a^2$ for some positive integer m, then R is

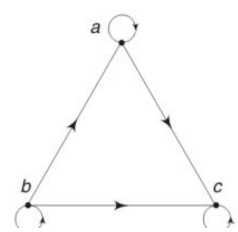
a) Reflexive relation b) Symmetric relation c) **Anti -symmetric relation** d) Transitive relation

26) If R is the equivalence relation on the set A = {1, 2, 3, 4, 5, 6} is R = {(1, 1), (1, 2), (2, 1), (2, 2), (3, 3), (4, 4), (4, 5), (5, 4), (5, 5), (6, 6)}, The partition of A induced by R is

a) {1, 5}, {3}, {4, 2}, {6} b) {1, 2}, {3}, {4, 6}, {5} c) {1, 3}, {2}, {4, 5}, {6} **d) {1, 2}, {3}, {4, 5}, {6}**

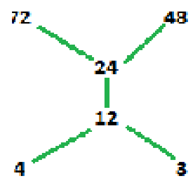
27) The relation R represented by the matrix $M_R = \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{pmatrix}$ is

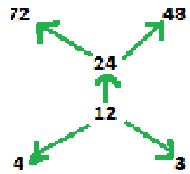
a) Partial order relation **b) equivalence relation** c) universal relation d) empty relation

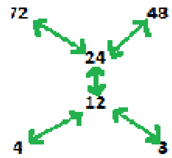
28) The ordered pairs in the relation represented by the digraph 

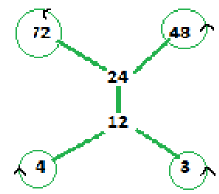
a)Partial order relation b) equivalence relation c) universal relation d) empty relation

29) The Hasse diagram for ({3, 4, 12, 24, 48, 72}, /) is

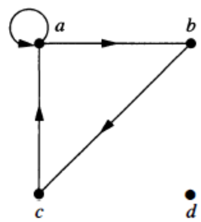
a) 

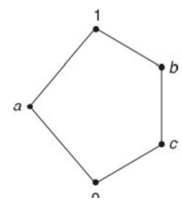
b) 

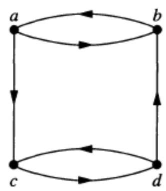
c) 

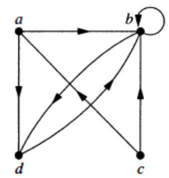
d) 

30) Which one of the following is a Hasse Diagram

a) 

b) 

c) 

d) 

31) The symmetric closure of the relation R = {(a,b) / a >b} on the set of positive integers is

a) $R \cup R^{-1} = \{(a,b) / a \neq b\}$ b) $R \cup R^{-1} = \{(a,b) / a = b\}$

c) $R \cap R^{-1} = \{(a,b) / a \neq b\}$ d) $R \cap R^{-1} = \{(a,b) / a = b\}$

32) Warshall's algorithm is based on the construction of a sequence of

a) zero-one matrices. b) one-zero matrices c) zero-zero matrices d) one-one matrices

33) Using Warshall's algorithm write the relation matrix W_1 if $W_0 = \begin{pmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \end{pmatrix}$,

a) $\begin{pmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \end{pmatrix}$ **b)** $\begin{pmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 \end{pmatrix}$ c) $\begin{pmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 1 \end{pmatrix}$ d) $\begin{pmatrix} 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 \end{pmatrix}$

34) Using Warshall's algorithm write the relation matrix W_2 if $W_1 = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$ is

a) $\begin{pmatrix} 0 & 1 & 0 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \end{pmatrix}$ b) $\begin{pmatrix} 1 & 1 & 0 \\ 1 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$ **c)** $\begin{pmatrix} 1 & 1 & 1 \\ 1 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$ d) $\begin{pmatrix} 0 & 1 & 0 \\ 1 & 1 & 0 \\ 0 & 1 & 1 \end{pmatrix}$

35) If f:A→A defined by {(1, a),(2, 2),(3, 3)} is identity function, then " a" =

a) 1 b) 2 c) 3 d) -1

36) The domain of $f(x)=\dfrac{1}{x-1}$ is a) R **b) R-{1}** c) Z d) Z-{-1}

37) If f: A $\rightarrow$ R is defined by f(x) = $2x^2$ -3 and if A={0, 1, 2 } then the range of f =

a) { 3,-1,5} b) { 3,-1,-5 } **c) { -3,-1,5 }** d) { -3,-1,-5 }

38) Let f be the function that assigns the last two bits of a bit string of length 2 or greater to that string, then the codomain and range are the set

a){ 00, 01, 10, 11 } b) { 00, 11 }
c) { 01 , 10 } d) { 00 , 10 , 11}

39) The inverse of the function $f(x)=e^{2x-5}$ is

a) $\frac{1}{2}(\log x-5))$ **b)** $\frac{1}{2}(\log x+5))$ c) $2(\log x-5))$ d) $2(\log x+5))$

40) Let f be the function from {a , b, c, d} to { 1 , 2, 3, 4} with f(a) = 4, f(b) = 2, f(c) = 1, and f(d) = 3 . Then f is

a) In to function b) many to one function **c) bijective function** d) only one to one

41) If $g \circ f$ i s not defined, because

a) the range of f i s not a subset of the domain of g b) the range of f i s a subset of the domain of g

c) the domain of f i s not a subset of the range of g d) the domain of f i s a subset of the range of g

42) Let f and g be the functions from the set of integers to the set of integers defined by f(x) = 2x + 3 and g(x) = 3x + 2. Then $f \circ g$ is

a) 7x - 6 b) 7x + 6 c) 6x - 7 **d) 6x + 7**

43) Let A = { 1, 2,3,4,5} and B = { 1 , 2 , 3 , 8, 9} and the functions f and g is defined as f = { (1,8) , (3,9) , (4, 3) ,(2,1) , (5,2)} and g = { (1,2) , (3,1),(2,2),(4,3),(5,2)} then $(f \circ g)(3)$ =

a) 9 **b) 8** c) 3 d) 2

44) If $f, g : R \rightarrow R$,where f(x) = ax + b , g(x) = 1- x – x^2 and $(g \circ f)(x)=9x^2-9x+3$ then the value of 'a' , 'b' is **a) a = 3,b= -4 or a = -3, b = 2** b) a = 3,b=4 or a = -3, b = -2
c) a = 3,b= 2 or a = -3, b = -1 d) a = -4,b= 3 or a = 4, b = -2

45) The inverse of the function $f : N \rightarrow N \; defined \; by \; f(x)=\begin{cases} 2x-1 & if \; x>0 \\ -2x & if \; x \le 0 \end{cases}$, then f^{-1} =

a) $f^{-1}(x)=\begin{cases} -\dfrac{x+1}{2} & if \; x=1,3,5....... \\ \dfrac{x}{2} & if \; x=0,2,4,....... \end{cases}$ b) $f^{-1}(x)=\begin{cases} \dfrac{x-1}{2} & if \; x=1,3,5....... \\ \dfrac{x}{2} & if \; x=0,2,4,....... \end{cases}$

c) $f^{-1}(x)=\begin{cases} \dfrac{x+1}{2} & if \; x=0,2,4....... \\ -\dfrac{x}{2} & if \; x=1,3,5,....... \end{cases}$ **d)** $f^{-1}(x)=\begin{cases} \dfrac{x+1}{2} & if \; x=1,3,5....... \\ -\dfrac{x}{2} & if \; x=0,2,4,....... \end{cases}$