UNIT – I (Vanshika)

DATE

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Subject : Discrete Mathematics

Unit - 1

1. Cartesian Product of set A and B is defined as the set of all ordered pairs (x, y) such that $x \in A$ and $y \in B$.

2. Example : $A = \{1, 2\}$ $B = \{a, b\}$
$A \times B = \{(1,a), (1,b), (2,a), (2,b)\}$

3. Cartesian Product of a set with itself ?
If $A = B$, we can denote the cartesian product of A with itself as $A \times A = A^2$, also known as Cartesian Square.

4. Size of Cartesian product of two sets :

$$\underbrace{|A \times B|}_{\text{Size of } A\times B} = \underbrace{|A|}_{\text{Size of A}} \times \underbrace{|B|}_{\text{Size of B}}$$

5. Cartesian product of two sets A and B, denoted $A \times B$ is set of all ordered pairs where a is in A,

and b is in B.

Ans → Yes

6. Relation : A collection of ordered pair containing one object from each set.

Example : $\{(2,-1), (3,3), (7,5), (8,4)\}$

7. Empty Relation : A relation in which there is no relation between any element of a set.

In other words, a relation R on set A is called empty relation, if no element of A is related to any element of A.

Set $A = \{1, 2, 3, 4\}$

$R = \{(a,b) : a+b = 10\}$ defined on A.

8. Symmetric Relation : In a symmetric Relation, if $a=b$ is true then $b=a$ is also true.

In other words, a R Relation is symmetric only if $(b,a) \in R$ is true when $(a,b) \in R$.

Set $B = \{1, 2\}$ $R = \{(1,2), (2,1)\}$

9. how many symmetric relations on a set with n elements

Ans.The number of symmetric relations on a set with the 'n' number of elements is given by N = 2n(n+1)/2, where N is the number of symmetric relations and n is the number of elements in the set.

10 . What is antisymmetric relation example?

Ans. In set theory, the relation R is said to be antisymmetric on a set A, if xRy and yRx hold when x = y. Or it can be defined as, relation R is antisymmetric if either (x,y)∉R or (y,x)∉R whenever x ≠ y.

11.How many reflexive relations are possible with n elements?

Ans. $2^{(n^2-n)}$

12. Write the smallest reflexive relation on set {1, 2, 3, 4}.

Ans. Smallest Reflexive Set={(1,1),(2,2),(3,3),(4,4)}

13. what is the cardinality of smallest reflexive relation if no. of elements in set is n.

Ans. CARDINALITY will be n .

Example : set A ={1, 2, 3, 4}.

|A|=4

Smallest Reflexive Set={(1,1),(2,2),(3,3),(4,4)} |Smallest Reflexive Set|=4

14.what is the cardinality of largest reflexive relation if no. of elements in Set is n.

Ans. CARDINALITY will be $2^{(n*(n-1))}$

15 I 15 How many reflexive relations are there on a set with n elements?

Ans. $2^{(n^2-n)}$

16 I 16 what is the cardinality of smallest symmetric relation if no. of elements In set is n.

Ans. CARDINALITY will be 0

17 I 17 what is the cardinality of largest symmetric relation if no. of elements in set is n.

Ans. CARDINALITY will be $2^{(n*(n-1))}$

18 I 18 How many symmatric relations are there on a set with n elements?

Ans.The number of symmetric relations on a set with the 'n' number of elements is given by **N = 2n(n+1)/2,** where N is the number of symmetric relations and n is the number of elements in the set.

19 I 19 what is the difference between reflexive relation and symmetric.

Ans.The Reflexive Property states that for every real number x , x=x . The Symmetric Property states that for all real numbers x and y , if x=y , then y=x .

20 I 20 what is transitive relation?

Ans. A relation R on a set X is transitive if, for all elements a, b, c in X, whenever R relates a to b and b to c, then R also relates a to c.

21 I 21 Give an example of a relation which is reflexive and symmetric but not Transitive.

Ans. If a, b, c ∈A such that (a, b) ∈ R and (b, c) ∈ R then (a, c) ∈ R so this is called a transitive relation. So as we see that, (4,6),(6,8)∈R for all a, b, c∈A. ... Hence R is a reflexive and symmetric but not transitive.

22 I 22 What is meant by transitive relation?

Ans. A relation R on a set X is transitive if, for all elements a, b, c in X, whenever R relates a to b and b to c, then R also relates a to c.

23 I 23 What is an example of the transitive property?

Ans. Example of a transitive law is “If a is equal to b and b is equal to c, then a is equal to c.”

24 I 24 What is Irreflexive relation with example?

Ans. A relation R on set A is said to be irreflexive if (a, a) ∉ R for every a ∈ A.

Example : A relation R on set A is said to be irreflexive if (a, a) ∉ R for every a ∈ A. Example: Let A = {1, 2, 3} and R = {(1, 2), (2, 2), (3, 1), (1, 3)}.

25 I 25 What is the difference between reflexive relation and irreflexive Relation?

Ans. Reflexive: every element is related to itself.

Irreflexive: no element is related to itself.

26 I 26 What is the cardinality smallest reflexive relation?

Ans. We have set {a, b, c, d} then the smallest reflexive relation on this set is { (a, a), (b, b), (c, c), (d, d) }.

CARDINALITY will be n .

27 I 27 What is Irreflexive relation with example?

Ans. Let A = {1, 2, 3} and R = {(1, 2), (2, 2), (3, 1), (1, 3)}.

28 **I 28 What is the cardinality largest reflexive relation?**

Ans. CARDINALITY will be 2^(n*(n-1))

29 I 29 How many irreflexive relations are possible with n elements?

Ans. Irreflexive Relations on a set with n elements : 2n(n-1).

30 I 30 How many antisymmetric relations are possible with n elements?

Ans. Anti-Symmetric Relations on a set with n elements: 2^n 3^n(n-1)/2

31 **I 31 What is the cardinality smallest antisymmetric relation?**

Ans. 0

32 **I 32 What is the cardinality largest antisymmetric relation?**

Ans. CARDINALITY will be 2^(n*(n-1))

33 I 33 What is asymmetric relation with example?

Ans. A relation is asymmetric if and only if it is both antisymmetric and irreflexive.

Example: the relation R on a set A is asymmetric if and only if,
$(x,y) \in R \Longrightarrow (y,x) \notin R$. ... For example: If R is a relation on set A = {12,6} then $\{12,6\} \in R$ implies 12>6, but $\{6,12\} \notin R$, since 6 is not greater than 12.

34 I 34 What is asymmetric and antisymmetric relation?

Ans. Antisymmetric means that the only way for both aRb and bRa to hold is if a = b. It can be reflexive, but it can’t be symmetric for two distinct elements.

Asymmetric is the same except it also can’t be reflexive. An asymmetric relation never has both aRb and bRa, even if a = b.

35 I 35 How many asymmetric relations are there in a set with n elements?

Ans. Number of Asymmetric Relations on a set with n elements : 3n(n-1)/2.

36 I 36 For a given set, relation is defined as (a,b) in R then (b,a) is also in R, Then R should be ?

Ans. R should be symmetric.

37 I 37 For every relation R on some set, if (t,t) is not in, then R cannot be

Ans. Reflexive

38 I 38 Product of first n natural numbers Ans. Product=n!

39 I 39 What is the Cartesian product of A = {1, 2} and B = {a, b}?

Ans. A×B={(1,a),(1,b),(2,a),(2,b)}

40 I 40 A partial ordered relation is transitive, reflexive and

Ans. Partial order relation is a homogeneous relation that is transitive and antisymmetric.

41 I 41 The set of positive integers is _________ .

Ans. Natural Number/ Never ending/Infinte

42 I 42 Power set of empty set has exactly _____ subset.

Ans.The empty number of elements is 0. So the number of subset in the power set of an empty set is 2^0=1.

43 I 43 The set O of odd positive integers less than 10 can be expressed by

Ans. 0={1,3,5,7,9}

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44 I 44The members of the set S = {x | x is the square of an integer and x < 100} is

Ans. S={1,4,9,16,25,36,49,64,81}

45 I 45 If a set has n elements, how many relations are there from A to A.

Ans.A contains n^2 elements. A relation is just a subset of A×A, and so there are 2^n^2 relations on A. So a 3-element set has 29 = 512 possible relations.

46 I 46 If A has m elements and B has n elements. How many relations are There from A to B and vice versa?

Ans. m×n elements

47 I 47 If a set A = {1, 2}. Determine all relations from A to A.

Ans. There are 2^2= 4 elements i.e., {(1, 2), (2, 1), (1, 1), (2, 2)} in A x A. So, there are 2^4= 16 relations from A to A.

They are : { {(1, 2), (2, 1), (1, 1), (2, 2)}, {(1, 2), (2, 1)}, {(1, 2), (1, 1)}, {(1, 2), (2, 2)}, {(2, 1), (1, 1)},{(2,1), (2, 2)}, {(1, 1),(2, 2)},{(1, 2), (2, 1), (1, 1)}, {(1, 2), (1, 1), (2, 2)}, {(2,1), (1, 1), (2, 2)}, {(1, 2), (2, 1), (2, 2)}, {(1, 2), (2,1)} }

48 I 48 Let A = {1, 2, 3, 4} B = {a, b, c, d}

R = {(1, a), (1, b), (1, c), (2, b), (2, c), (2, d)}. Find domain and Range.?

Ans. Domain of R={1,2}

Range of R= {a, b, c, d}

49 I 49 Consider the relation R from X to Y

X = {1, 2, 3}

Y = {8, 9}

R = {(1, 8) (2, 8) (1, 9) (3, 9)}

Find the complement relation of R.

Ans. Compliment of a relation will contain all the pairs where pair do not belong to relation but belongs to Cartesian product. R' = P * Q – R

X*Y= {(1,8),(1,9),(2,8),(2,9),(3,8),(3,9)}

Complement: R'={(2,9),(3,8)}

50 I 50 Let X = {4, 5, 6}, Y = {a, b, c} and Z = {l, m, n}. Consider the relation R1 from X to Y and R2 from Y to Z.

R1 = {(4, a), (4, b), (5, c), (6, a), (6, c)}

R2 = {(a, l), (a, n), (b, l), (b, m), (c, l), (c, m), (c, n)} Find the Composition of relation R1 o R2 .

Ans. $X = \{4, 5, 6\}$

$Y = \{a, b, c\}$

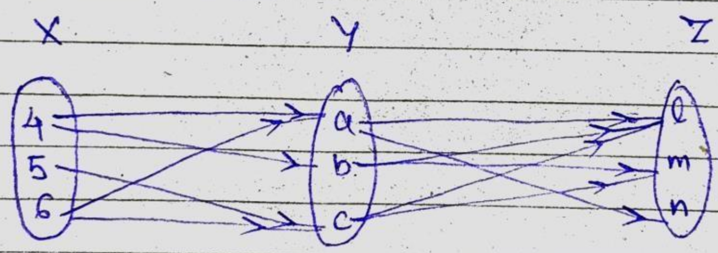
$Z = \{l, m, n\}$

$R_1 = \{(4, a), (4, b), (5, c), (6, a), (6, c)\} : X \to Y$

$R_2 = \{(a, l); (a, n)\}, (b, l), (b, m), (c, l), (c, m), (c, n)\}$

Composition of R_1 & R_2:

$R_1 \circ R_2$



$R_1 \circ R_2 \Rightarrow \{(4, l) (4, n) (4, m) (5, l) (5, m) (5, n)$
$(6, l) (6, m) (6, n)\}$

51 I 51Let A = {1, 2, 3} and R = {(1, 2), (2, 2), (3, 1), (1, 3)}. Is the relation R Reflexive or irreflexive?

Ans. Irreflexive.

52 I 52Let A = {1, 2, 3} and R = {(1, 1), (2, 2)}. Is the relation R Antisymmetric?

Ans. Yes , because 1=1 and 2=2.

53 I 53 Let A = {4, 5, 6} and R = {(4, 4), (4, 5), (5, 4), (5, 6), (4, 6)}. Is the Relation R antisymmetric?

Ans. No, Asymmetric Because (6,5) and (6,4) is not present.

54 I 54 Let A = {1, 2, 3} and R = {(1, 2), (2, 1), (1, 1), (2, 2)}. Is the relation Transitive?

Ans. Yes

55 I 55Let A = {1, 2, 3, 4} and R = {(1, 1), (1, 3), (2, 2), (2, 4), (3,1), (3, 3), (4, 2), (4, 4)}.

Show that R is an Equivalence Relation.

Ans. A = {1, 2, 3, 4}

R = {(1, 1), (1, 3), (2, 2), (2, 4), (3, 1), (3, 3), (4, 2), (4, 4)}

for R to be Equivalence

1) It should be Reflexive

as R contain (1, 1) (2, 2) (3, 3) (4, 4) i.e (a, a) ∈ R

∴ R is Reflexive.

2) It should be Transitive

as all (a, b) ∈ R Have (b, a) ∈ R i.e. (1, 3) ∈ R ⇒ (3, 1) ∈ R and (2, 4) ∈ R ⇒ (4, 2) ∈ R.

∴ R is transitive

3) It should be Symmetric

as all (a, b) ∈ R, (b, c) ∈ R ⇒ (a, c) ∈ R i.e.

(1, 1) ∈ R (1, 3) ∈ R ⇒ (1, 3) ∈ R

(2, 4) ∈ R (4, 2) ∈ R ⇒ (2, 2) ∈ R

(1, 3) ∈ R (3, 1) ∈ R ⇒ (1, 1) ∈ R

--- and so on.

∴ R is symmetric

Hence, R is Equivalence Relation.

56 I 56. A = {1, 2, 3}

R1 = {(1, 1), (2, 2), (3, 3), (1, 2), (2, 1)}

R2 = {(1, 1), (2, 2), (3, 3), (2, 3), (3, 2)} find R1 ∩ R2.

Ans.R1 ∩ R2= {(1, 1), (2, 2), (3, 3)}

57 I 57 R = {(1, 1), (2, 2), (3, 3), (1, 2), (2, 3), (3, 2)} find R^-1. Ans. R^-1= {(1, 1), (2, 2), (3, 3), (2, 1), (3,2), (2,3)}

58 I 58 Show that the relation 'Divides' defined on N is a partial order relation.

Ans. **Reflexive**: We have a divides a, ∀ a∈N. Therefore, relation 'Divides' is reflexive.

Antisymmetric: Let a, b, c ∈N, such that a divides b. It implies b divides a iff a = b. So, the relation is antisymmetric.

Transitive: Let a, b, c ∈N, such that a divides b and b divides c.

Then a divides c. Hence the relation is transitive. Thus, the relation being reflexive, antisymmetric and transitive, the relation 'divides' is a **partial order relation.**

59 I 59 Find the Domain, Co-Domain, and Range of function.

Domain: Set of first element of the ordered pair which belongs to R.

Range : Set of all second elements of ordered pairs.

Codomain: set of all possible elements of ordered pairs.

Ex: Let A = {1, 2}   B = {a, b, c, d,e ,f,g,h,i,j}

R = {(1, a), (1, b), (1, c), (2, b), (2, c), (2, d)}.

Domain of R={1,2}

Range of R= {a, b, c, d}

Co domain of R={a, b, c, d,e ,f,g,h,i,j}

60 I 60 A function is said to be _______, if and only if f(a) = f(b) Implies that a = b for all a and b in the domain of f.

Ans. One-one

61 I 61 If a set A has n elements, how many functions are there from A to A.

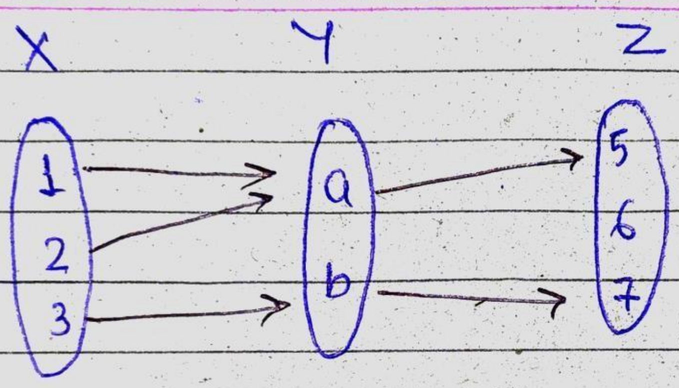
Ans.The number of functions that can be defined from a set into another set can be found by:

(Number of elements in co-domain) ^Number of elements in domain.

No. Of Function = n^n

62 I 62. Let X = {x, y, z, k} and Y = {1, 2, 3, 4}. Give reasons if it is not. Find range if it is a function.

Ans.



$gof(1) = g[f(1)] = g(a) = 5$

$gof(2) = g[f(2)] = g(a) = 5$

$gof(3) = g[f(3)] = g(b) = 7$

Ans. What is function .

63 I 63. Let X = {1, 2, 3} Y = {a, b} Z = {5, 6, 7}. Consider the function f = {(1, a), (2, a), (3, b)} and g = {(a, 5), (b, 7)} as in figure. Find the composition of gof.

Ans.

64 I 64.Consider f, g and h, all functions on the integers, by f (n) =n2, g (n) = n + 1 and h (n) = n - 1.

Determine (i) hofog

Ans.

Ans (i) hofog (n)·

$\Rightarrow hof[g(n)]$

$\Rightarrow ho[f\ (n+1)]$

$\Rightarrow ho[f(n+1)]$

$\Rightarrow h[(n+1)^2]$

$\Rightarrow (n+1)^2 - 1$

$\Rightarrow n^2+1+2n-1 \quad \Rightarrow n^2+2n \Rightarrow n(n+2)$

65 I 65.Consider f, g and h, all functions on the integers, by f (n) =n2, g (n) = n + 1 and h (n) = n - 1.Determine (ii) gofoh Ans.

Ans (ii) $gofo[h(n)]$

$\Rightarrow gof\ (n-1)$

$\Rightarrow g[f(n-1)]$

$\Rightarrow g[(n-1)^2]$

$\Rightarrow (n-1)^2+1$

$\Rightarrow n^2+1-2n+1$

$\Rightarrow n^2+2-2n.$ or $n^2-2n+2.$

66 I 66Consider f, g and h, all functions on the integers, by f (n) =n2, g (n) = n + 1 and h (n) = n - 1.Determine (iii) fogoh.

Ans (iii) $f \circ g \circ [h(n)]$

$\Rightarrow f \circ g\,[n-1]$

$\Rightarrow f\,[g(n-1)]$

$\Rightarrow f\,[n-1+1] \Rightarrow f(n)$

$\Rightarrow n^2$

67 I 67.Find the minimum number of students in a class to be sure that three of them are born in the same month.

Ans.The generalized Pigeonhole principle:

Assume N objects are placed into k boxes. N=12,k+1=3;k=2.

So, there is at least one box containing at least N/k objects.

To use the pigeonhole principle, first, find boxes and objects.

Suppose that for each month, we have a box that contains persons who were born in that month. The number of boxes is 12, by the generalized pigeonhole principle, to have at least 3 (= N/12) students at the same box, the total number of the students must be at least N = **2*12 + 1 = 25.(k.n+1)**

So, the minimum number of students required= **25**.

68 I 68. Show that at least two people must have their birthday in the same month if 13 people are assembled in a room.

Ans.Suppose that for each month, we have a box that contains persons who were born in that month. The number of boxes is 12, by the generalized pigeonhole principle, to have at least 2 (= N/12) students at the same box, the total number of the students must be at least N = 12*1 + 1 = 13.

So, the minimum number of students required= **13**.

69 I 69The Cartesian Product B x A is equal to the Cartesian product A x B. Is it True or False?

Ans. False.

70 I 70 What is Commutative, Associative and Distributive laws in maths?

Ans. **Commutative law**, in mathematics, either of two laws relating to number operations of addition and multiplication, stated symbolically: **$a + b = b + a$ and $ab = ba$.**

Associative Laws ,in mathematics, either of two laws relating to number operations of addition and multiplication, stated symbolically**: $(a + b) + c = a + (b + c)$, $(a \times b) \times c = a \times (b \times c)$.**

Distributive Law: $a \times (b + c) = a \times b + a \times c$.

71 I 71.In a class of 120 students numbered 1 to 120, all even numbered students opt for Physics, those whose numbers are divisible by 5 opt for Chemistry and those whose numbers are divisible by 7 opt for Math. How many opt for none of the three subjects?

Ans.

Ans.

$P = \{2, 4, 6, ---, 118, 120\}$ $n(P) = 60$

$C = \{5, 10, 15, ..., 115, 120\}$ $n(C) = 24$

$M = \{7, 14, 21, ..., 112, 119\}$ $n(M) = 17$

$n(P \cap C) = 12$ → LCM . 2 & 5 = 10 → multiple of 10 (1-1

$n(C \cap M) = 3$ → LCM 5 & 7 = 35 → multiples of 35 (1-120)

$n(P \cap M) = 8$ → (similarly)

and $n(P \cap C \cap M) = 1$

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

$1 = 60 + 24 + 17 - (12 + 3 + 8) - x$

$[x = 79]$

Who opt none = 120 - 79 = 41 students.

Number of students who opt for none of the subjects =120−79=41.

72 I 72 .In a class of 40 students, 12 enrolled for both English and German. 22 enrolled for German. If the students of the class enrolled for at least one of the two subjects, then how many students enrolled for only English and not German?

Ans.

Ans. $n(E \cap G) = 12$

$n(E) = 30$

$n(E - G) = n(E) - n(E \cap G)$

$= 30 - 12 = 18$

73 I 73.In a class 40% of the students enrolled for Math and 70% enrolled for Economics. If 15% of the students enrolled for both Math and Economics, what % of the students of the class did not enroll for either of the two subjects?

Ans n(A ⋃ B) = n(A) + n(B) – n(A ∩ B), where (A ⋃ B) represents the set of people who have enrolled for at least one of the two subjects Math or Economics and (A ∩ B) represents the set of people who have enrolled for both the subjects Math and Economics.

N(A ⋃ B) = 40 + 70 – 15 = 95%

That is 95% of the students have enrolled for at least one of the two subjects Math or Economics.

Therefore, the balance (100 – 95)% = **5%** of the students have not enrolled for either of the two subjects.

74 I 74 what is equivalence set.?

Ans.Two sets A and B are said to be equivalent if they have the same cardinality i.e. n(A) = n(B).

75 I 75. what is equal set.?

Ans.Two sets A and B can be equal only on the condition that each element of set A is also the element of set B. Also, if two sets happen to be the subsets of each other, then they are stated to be equal sets.

76 I 76 what is the defference between subset and proper subset.?

Ans. **Subset of a set A can be equal to set A but a proper subset of a set A can never be equal to set A.** A proper subset of a set A is a subset of A that cannot be equal to A. In other words, if B is a proper subset of A, then all elements of B are in A but A contains at least one element that is not in B.

77 I 77 what is power subset.

Ans. A power set includes all the subsets of a given set including the empty set.

78 I 78 what is Idempotent laws on a set.?

Ans. Intersection and union of any set with itself revert the same set.

Idempotent Laws (a) $A \cup A = A$ (b) $A \cap A = A$

79 I 79 what is Distributive law .?

Ans. For all sets A,B and C, $A\cap(B\cup C)=(A\cap B)\cup(A\cap C)$ and $A\cup(B\cap C)=(A\cup B)\cap(A\cup C)$.

80 I 80. Let U be the set of positive integer not exceeding 1000. Then $|U|= 1000$ and find S where S is the set of such integer which is not divisible by 3, 5 or 7?

Ans. Let A be the subset of integer which is divisible by 3

Let B be the subset of integer which is divisible by 5

Let C be the subset of integer which is divisible by 7

Then $S = Ac \cap Bc\cap Cc$ since each element of S is not divisible by 3, 5, or 7.

By Integer division,

$|A|= 1000/3 = 333$

$|B|= 1000/5 = 200$

$|C| = 1000/7 = 142$

$|A\cap B|=1000/15=66$ $|B\cap C|=1000/21=47$

$|C\cap A|=1000/35=28$

$|A\cap B\cap C|=1000/105=9$

Thus by Inclusion-Exclusion Principle

$|S|=1000-(333+200+142)+(66+47+28)-9$

$|S|=1000-675+141-9=457$

81 I 81 What is the cardinality of the set of odd positive integers less than 10?

Ans.Set S of odd positive an odd integer less than 10 is {1, 3, 5, 7, 9}. Then, Cardinality of set S = |S| which is 5.

82 I 82.Which of the following two sets are equal?

a) A = {1, 2} and B = {1}

b) A = {1, 2} and B = {1, 2, 3}

c) A = {1, 2, 3} and B = {2, 1, 3}

d) A = {1, 2, 4} and B = {1, 2, 3}

Ans. C) A = {1, 2, 3} and B = {2, 1, 3}

83 I 83 What is the Cardinality of the Power set of the set {0, 1, 2}.

Ans.2^n; 2^3=8.

84 I 84Let A and B be two finite sets such that n(A) = 20, n(B) = 28 and n(A ∪ B) = 36, find n(A ∩ B).

Ans. n(A ∩ B)= n(A) + n(B) – n(A ∩ B) n(A ∩ B)= 20+28-36=12.

85|85.In a group of 60 people, 27 like cold drinks and 42 like hot drinks and Each person likes at least one of the two drinks. How many like both Coffee and tea?

Ans.Let A = Set of people who like cold drink

And, B = Set of people who like hot drink

Given,

N(A∪B)=60

N(A)=27 and n(B)=42

N(A∩B)=n(A)+n(B)−n(A∪B)

N(A∩B)=27+42−60=9

Therefore, 9 people like both cold drink and hot drink.

86 I 86.If A has 4 elements B has 8 elements then the minimum and maximum Number of elements in A U B are ____________

Ans. Minimum: 4 (Minimum would be when 4 elements are same as in 8, maximum would be when all are distinct.) Maximum:12.

87 I 87.Two sets A and B contains a and b elements respectively. If power set Of A contains 16 more elements than that of B, value of ‘b’ and ‘a’ are

Ans Power set of A $\rightarrow 2^a$ } no. of element

Power set of B $\rightarrow 2^b$

$$2^b = 2^a + 16$$

$$2^b = 2^a + 2^4$$

Therefore , a=4 and b=5.

88 I 88 If n(A)=20 and n(B)=30 and n(A U B) = 40 then n(A ∩ B) is?

Ans. N(A ∩ B)= n(A) + n(B) – n(A ∩ B) N(A ∩ B)= 20+30-40=20.

89 I 89.Let the students who likes table tennis be 12, the ones who like lawn Tennis 10, those who like only table tennis are 6, then number of Students who likes only lawn tennis are, assuming there are total of 16 Students.

90 I 90 Let the set A is {1, 2, 3} and B is {2, 3, 4}. Then the set A – B is?

A-B={1}.

91 I 91 What Is Discrete Mathematics?

Ans.Discrete mathematics is the study of mathematical structures that are fundamentally discrete rather than continuous.

92 I 92 how many Categories Of Mathematics?

Ans.Modern mathematics can be divided into three main branches: continuous mathematics, algebra, and discrete mathematics.

93 I 93 what are diffrence between continuous and discrete mathematics.

Ans. Continuous mathematics deals with real numbers.

Discrete math deals with sets of items, numbers.

94 I 94 . What Is Sets In Discrete Mathematics?

Ans. Set is an unordered collection of different elements.

95 I 95 Give Some Example of Sets

Ans. A = {1, 2, 3} and B = {2, 1, 3}.

96 I 96 How Many Ways Represent A Set?

Ans.There are three ways to represent a set.

a) Tabular form / Roaster form

b) Representative form

c) Set-Builder form

97 I 97 Write Set of vowels in English alphabet,in roster form .

Ans. Vowel= {a,e,i,o,u}

98 I 98 Write Set of odd numbers less than 10, in roster form

Ans. Odd={ 1,3,5,7,9}

99 I 99. Write Set of vowels in English alphabet,in set builder notation.

Ans .Vowel ={x: x is vowel,x belongs to alphabet}

100 I 100. Explain Some Important Sets?

Ans. Natural numbers={1,2,3…} Integers={1/2,3/4,4/5….},etc.

101 I 101 What Is Cardinality Of A Set?

Ans .Number of elements of set is cardinality.

102 I 102 What is cardinality of |{1,4,3,5………}| Ans. Infinte.

103 I 103 What is cardinality of |{1,4,3,5}|

Ans. 4

104 I 104 what is Finite Set

Ans. Finite set : Set which have finite no. Of elements in it.

105 I 105 what is Infinite set.

Ans. INFINITE SET : Set in which no. Of elements are infinite.

106 I 106 what is Subset

Ans. Set A is a subset of a set B if all elements of A are also elements of B; B is then a superset of A.

107 I 107 What is Proper Subset

Ans. A proper subset of a set A is a subset of A that is not equal to A. In other words, if B is a proper subset of A, then all elements of B are in A but A contains at least one element that is not in B.

108 I 108 What is Universal Set

Ans.The universal set is the set of all elements or members of all related sets.

109 I 109 What is Empty Set or Null Set

Ans.Any Set that does not contain any element is called the empty or null or void set. The symbol used to represent an empty set is – {} or ϕ. Examples: Let A = {x : 9 < x < 10, x is a natural number} will be a null set because there is NO natural number between numbers 9 and 10.

110 I 110 what is cardinality of null set Ans.zero.

111 I 111 What is Singleton Set or Unit Set Ans. Set that consist exactly one element.

112 I 112 What is Equal Set

Ans. Two set are equal if they are subset of each other and have exactly same elements.

113 I 113 What Is Set Operations

Ans. Union , intersection , complement , difference.

114 I 114 What Is Power Set

Ans.power set (or power set) of a Set A is defined as the set of all subsets of the Set A including the Set itself and the null or empty set.

115 I 115 What Is Discrete Mathematics Functions?

Ans.Discrete mathematics is the study of mathematical structures that are fundamentally discrete rather than continuous.

116 I 116 What is the minimum number of students required in a discrete Mathematics class to be sure that at least six will receive the same Grade, if there are five possible grades, A, B, C, D, and F?

Ans.We have k = 5 and r = 6. We need to compute

N such that ⌈N/k⌉ = r or more precisely ⌈N/5⌉ = 6. We

Can compute the smallest integer with this property as N =

K(r – 1) + 1. Plugging k and r into this equation gives us N

= 5(6-1)+1 = 26. Thus, 26 is the minimum number of Students needed to ensure that at least six

students will Receive the same grade.

117|117Find the minimum number of students in a class to be sure that three of Them are born in the same month.

Ans.The generalized Pigeonhole principle:

Assume N objects are placed into k boxes. N=12,k+1=3;k=2.

So, there is at least one box containing at least N/k objects.

To use the pigeonhole principle, first, find boxes and objects.

Suppose that for each month, we have a box that contains persons who were born in that month. The number of boxes is 12, by the generalized pigeonhole principle, to have at least 3 (= N/12) students at the same box, the total number of the students must be at least N = 2*12 + 1 = 25.(k.n+1)

So, the minimum number of students required= 25.

Repeated 67

118 I 118 Show that at least two people must have their birthday in the same Month if 13 people are assembled in a room.

Repeated 68

119 **I 119 Bag contains 10 red marbles, 10 white marbles, and 10 blue marbles. What is the minimum no. of marbles you have to choose randomly From the bag to ensure that we get 4 marbles of same color?**

Ans.

Colours = 3 i.e, Pigeonholes $n = 3$

marbles = 4 i.e, Pigeons $K+1 = 4$ $K = 3$

$\therefore$ marbles required $= Kn+1$

$= 3 \times 3 + 1$

$= 10$

120 I 120

A box contains 6 red, 8 green, 10 blue, 12 yellow and 15 white balls.

What is the minimum no. of balls we have to choose randomly from

The box to ensure that we get 9 balls of same color?

Ans.On the assumption that you draw the balls at random without replacement, the minimum number of balls that gives you the certainty to get 9 balls of the same colour Is: 6+8+3*8+1=39. In fact, in the most unfavorable case you draw, in some order, 6 red +8 green + 8 blue + 8 yellow +8 white balls =38 and only the 39^{th} allows you to get either 9 blue or 9 yellow or 9 white balls.

UNIT – II (Sonu Banjara)

1	what is Partial Order Relations	it is a homogeneous relation that is reflexive, transitive and antisymmetric.
2	Show that "greater than or equal" relation is a partial ordering on the set of integers.	it is 1. reflexive : a>=a ; 2. Transitive : if a>=b & b>=c then a>=c ; 3. Antysymmetric : if a>=b & b>=a then a=b.
3	Show whether the relation (x, y) ∈ R, if, x ≥ y defined on the set of +ve integers is a partial order relation.	it is 1. reflexive : x>=x, y>=y ; 2. Transitive : if x>=y & y>=z then x>=z ; 3. Antysymmetric : if x>=y & x>=y then x=y.... hence it's partial order relation.
4	what is lattices	it is a poset in which every subset consisting of two elements has a least upper bound and a greatest lower bound
5	In the poset (Z+, |) (where Z+ is the set of all positive integers and | is the divides relation) are the integers 9 and 351 comparable?	yes since 9 divides 351.
6	totally ordered poset	poset with every pair of distinct elements comparable.
7	Join and meet	join of two subsets is their union and meet is their intersection.
8	bounded lattice	a lattice having a greatest element and a least element.
9	Which of the partially ordered sets are lattices?	
10	When a lattice is called complete?	if it has both join and meet.
11	What are the two binary operations defined for lattices?	join and meet.
12	whos made Hasse diagram first?	helmut hasse

13	what is upward planar	if a partial order relation is drawn as a hasse diagram in which no two edges cross , its graph covering is called as upward planar.
14	n a poset P({v, x, y, z}, ⊆) which of the greatest element?	{v,x,y,z}
15	Let G be the graph defined as the Hasse diagram for the ⊆ relation on the set S{1, 2,…, 18}. How many edges are there in G?	2359296 { no. of edges =n* 2^(n-1) = 18 * 2^17. }
16	How do you find the least element?	
17	What is a maximal element in a poset?	element which is not less than any other element of poset.
18	What is a minimal element in a poset?	element which is not greater than any other element of poset.
19	What is the difference in usage between maximum and maximal?	maximum is highest limit. maximal is an greatest or largest element.
20	What is full form LUB	least upper bound
21	What is full form GLB	greatest lower bound
22	What is least upper bound and greatest lower bound?	least upper bound - upper bound less than any other upper bound. greatest lower bound - lower bound greater than any other lower bound
23	What is least upper bound and greatest lower bound?	least upper bound - upper bound less than any other upper bound. greatest lower bound - lower bound greater than any other lower bound
24	what is Infimum?	greatest lower bound(join)
25	what is Supremum?	least upper bound(meet)
26	What is the difference between partial order relation and total order relation?	relation i.e. reflexive, transitive and antisymm is called partial. poset with every pair of distinct elements comparable is called total order.
27	What is propositional logic?	it is concerened with statements to which truth values, "true" and "false" can be assigned.
28	What are logical connectives?	to connect two or more propositional or predicate logic. there are 5 connectives
29	What are the 5 logical connectives?	OR (∨), AND (∧), Negation/ NOT (¬), Implication / if-then (→), If and only if (⇔).
30	What are the purpose of the logical connectives?	A Logical Connective is a symbol which is used to connect two or more propositional or predicate logics in such a manner that resultant logic depends only on the input logics and the meaning of the connective used.
31	What are the symbols for, and the meaning of, the four logical connectives?	1. OR (∨) − The OR operation of two propositions A and B (written as A ∨ B) is true if at least any of the propositional variable A or B is true. 2. AND (∧) − The AND operation of two propositions A and B (written as A∧B) is true if both the propositional variable A and B is true. 3. Negation (¬) − The negation of a proposition A (written as ¬ A) is false when A is true and is true when A is false. 4. Implication / if-then (→) − An implication A → B is the proposition “if A, then B”. It is false if A is true and B is false. The rest cases are true. 5. If and only

		if (⇔) − A ⇔ B is bi-conditional logical connective which is true when p and q are same, i.e. both are false or both are true.
32	What are simple statements?	statement that doesn't contain any operator.
33	What is compound statements?	statement that contain some operator like and , or etc.
34	What is the difference between simple and compound statements explain with example?	Statements that contain no operator we call simple statements; all others we call compound statements
35	What is a truth table?	A truth table is a tabular representation of all the combinations of values for inputs and their corresponding outputs.
36	How do you explain a truth table?	A truth table is a tabular representation of all the combinations of values for inputs and their corresponding outputs.
37	In what situation is a conjunction false (or true)?	The conjunction statement will only be true if both the combining statements are true otherwise, false.
38	what is a disjunct?	if p and q are statement variables, the disjunction of p and q is "p or q", denoted p ∨ q. A disjunction is true if one or both variables are true. p ∨ q is false only if both variables are false.
39	What is the disjunction of P and Q How is it denoted?	if p and q are statement variables, the disjunction of p and q is "p or q", denoted p ∨ q. A disjunction is true if one or both variables are true. p ∨ q is false only if both variables are false.
40	What is not logic?	Reverses the true/false outcome of the expression that follows.
41	What is not logic?	**Reverses the true/false outcome of the expression that follows.**
42	What is the negation of P and not Q?	**not P or Q**
43	What is conditional proposition	**a statement that proposes something is true on the condition that something else is true.For example "if p then q"**
44	How do you find the minimum terms and maximum terms?	**minterms are found by calculating SOP and maxterms are found by calculating POS.**
45	What is minimal Boolean function?	**expression with as few literals and product terms as possible.**
46	What are the minterms and maxterms in Boolean functions?	**Minterms are called products because they are the logical AND of a set of variables, and maxterms are called sums because they are the logical OR of a set of variables.**
47	What is meant by Max term?	**Maxterm is a sum of literals in which every input variable appears once and only once.**
48	What is K-map why we use k maps?	**a pictorial method used to minimize Boolean expressions without having to use Boolean algebra theorems.We use it because simpler and less error-prone**
49	What are the limitations of KMAP?	**It is not suitable for computer reduction.** **It is not suitable when the number of variables involved exceed four.**

50. What is K-map and its advantages?

Ans. The K-map simplification technique is simpler and less error-prone compared to the method of solving the logical expressions using Boolean laws.

Advantages :-

1.Minimizes boolean expressions without the need using various boolean theorems & computations.

2.Minimizes number of Logical gates used.

51. What is the difference between SOP and POS?

Ans.

SOP VERSUS POS

SOP	POS
A method of describing a Boolean expression using a set of minterms or product terms	A method of describing a Boolean expression using a set of max terms or sum terms
Stands for Sum of Products	Stands for Product of Sums
We write the product terms for each input combination that gives high (1) output	We write the sum terms for each input combination that gives low (0) output
We take the input variables if the value is 1 and write the complement of the variable if the value is 0 when writing the minterms	We take the input variables if the value is 0 and write the complement of the variable if its value is 1 when writing the maxterms
Final expression is obtained by adding the relevant product terms	Final expression is obtained by multiplying the relevant sum terms

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52. Which code is used in K map?

Ans. Gray Code

53. Who introduced K map?

Ans. Maurice Karnaugh

54. What are some applications of set theory in the real world?

Ans. Formulating logical foundation for geometry , calculus , and topology to creating algebra revolving around field, rings and groups .

55. Find the simplified expression A’BC’+AC’ .

Ans. (A+B)C’

56. Simplify the expression: A’(A + BC) + (AC + B’C).

Ans. (a'b+c')

57. Simplify the expression XZ’ + (Y + Y’Z) + XY

Ans. x + y + z

58. Find the simplified term Y’ (X’ + Y’) (X + X’Y)?

Ans. x y’

59. Minimize the following Boolean expression using Boolean identities.

Ans.

60. What is the value of x after this statement, assuming the initial value of x is 5? ‘If x equals to one then x=x+2 else x=0’.

Ans. 0

61. The binary relation {(1,1), (2,1), (2,2), (2,3), (2,4), (3,1), (3,2)} on the set {1, 2, 3} satisfies which characteristics .

Ans. Transitive

62. Consider the binary relation, A = {(a , b) | b = a – 1 and a, b belong to {1, 2, 3}}. The reflexive transitive closure of A is?

Ans. {(a , b) | a >= b and a, b belong to {1, 2, 3}}

63. Determine the characteristics of the relation a R b if a2 = b2.

Ans. symmetric, reflexive and transitive

64. say true or false

Relations may exist between?

A. objects of the same set

Ans. True

B. between objects of two or more sets

Ans. True

65. For two distinct sets, A and B, having cardinalities m and n respectively, the maximum cardinality of a relation R from A to B is ?

Ans. 2^{mn}

66. A relation can be represented using which graph?

Ans. Directed Graph

67. A relation R on set A is called _________ if xRy implies yRx.

Ans . Symmetric

68. The relation R={(a,b),(b,a)} on set X={a,b} is?

Ans. Irreflexive

69. If x ∈ N and x is prime, then x is ________ set.

Ans. Infinite Set

70. If x is a set and the set contains the real number between 1 and 2, then the set is __

Ans. Infinite Set

71. Convert the set x in roster form if set x contains the positive prime number, which divides 72

Ans . {2, 3}

72. Power set of empty or Null set has exactly _________ subset.

Ans . 1 i.e. { Φ }

73. What is the Cartesian product of set A and set B, if the set A = {1, 2} and set B = {a, b}?

Ans. {(1,a),(1,b),(2,a),(2,b)}

74. The members of the set S = {x | x is the square of an integer and x < 100} is _________________

Ans. { 0, 1 , 4 , 9 , 16 , 25 , 36 , 49 , 64 , 81 }

75. The intersection of the sets {1, 2, 8, 9, 10, 5} and {1, 2, 6, 10, 12, 15} is the set _______

Ans. { 1, 2, 10 }

76. The difference of {1, 2, 3, 6, 8} and {1, 2, 5, 6} is the set _________

Ans. { 3, 8 }

77. If n(A) = 20 and n(B) = 30 and n(A U B) = 40 then n(A ∩ B) is?

Ans. 10

78. Let the players who play cricket be 12, the ones who play football 10, those who play only cricket are 6, then the number of players who play only football are ___________, assuming there is a total of 16 players.

Ans . 4

79 The cardinality of the Power set of the set {1, 5, 6} is__________

Ans. 8

80 The Cartesian product of the (Set Y) x (Set X) is equal to the Cartesian product of (Set X) x (Set Y) or Not?

Ans. NO

81 How many elements in the Power set of set A= {{Φ}, {Φ, {Φ}}}?

Ans. 4

82 The number of reflexive closure of the relation {(0,1), (1,1), (1,3), (2,1), (2,2), (3,0)} on the set {0, 1, 2, 3} is________.

Ans. 6

83 The number of transitive closure exists in the relation R = {(0,1), (1,2), (2,2), (3,4), (5,3), (5,4)} where {1, 2, 3, 4, 5} ∈ A is__________.

Ans. 7

84 Canonical forms for a boolean expression has _______ types

Ans. 2 (SOP or POS)

85 Boolean algebra deals with how many values.

Ans. 2 (False(0) or True(1))

86 Let A and B be two non-empty relations on a set S.

the statements is true or false

A and B are transitive ⇒ AUB is not transitive

Ans. True

87 Let A and B be two non-empty relations on a set S.

the statements is true or false

A and B are transitive ⇒ A∩B is transitive

Ans. False

88 Let A and B be two non-empty relations on a set S.

the statements is true or false

A and B are symmetric ⇒ AUB is symmetric

Ans. False

89 Let A and B be two non-empty relations on a set S. the statements is true or false A and B are reflexive ⇒ A∩B is reflexive

Ans. False

90 Let a set S = {2, 4, 8, 16, 32} and <= be the partial order defined by S <= R if a divides b. Number of edges in the Hasse diagram of is ______

Ans. 5

91 Suppose a relation R = {(3, 3), (5, 5), (5, 3), (5, 5), (6, 6)} on S = {3, 5, 6}. Here R is known as ______

Ans. equivalence relation

92 Determine the number of equivalence classes that can be described by the set {2, 4, 5}.

Ans. 5

93 Minimize the following Boolean Expression f(A, B, C) = AB' C+A' BC+AB+A' B' C

Ans. a(b' + c)

94 Minimize the following Boolean Expression using k-map : f(A, B) = A' B+BA

Ans. B

95 Minimize the following Boolean Expression using k-map : AB + A' B+BA'

Ans. B

96 Write the dual of Boolean expressions:(x1*x2) + (x1*x3')

Ans. (x1+x2) * (x1+x3')

97 Write the dual of Boolean expressions:(1+x2)*(x1+1)

Ans. (0*x2)+(x1*0)

98 Write the dual of Boolean expressions: (a ∧(b∧c))

Ans. (a V (b V c))

99 If a set has n elements, how many relations are there from A to A.

Ans. $2n^2$ (2 to the power n^2)

100 If A has m elements and B has n elements. How many relations are there from A to B and vice versa?

Ans. 2^{m*n}

101. Let A = {1, 2, 3, 4} B = {a, b, c, d} R = {(1, a), (1, b), (1, c), (2, b), (2, c), (2, d)}. what is domain and range of relation?

Ans. {1 , 2 }

102. If A = {1, 2, 3, 4} then R = {(1, 1) (2, 2), (1, 3), (2, 4), (3, 3), (3, 4), (4, 4)}. Is a relation reflexive?

Ans. (yes) reflexive.

103. Let A = {1, 2, 3} and R = {(1, 2), (2, 2), (3, 1), (1, 3)}. Is the relation R reflexive or irreflexive?

Ans. (yes) Reflexive

104. Let A = {1, 2, 3} and R = {(1, 1), (2, 2), (1, 2), (2, 1), (2, 3), (3, 2)}. Is a relation R symmetric or not?

Ans. (yes)Symmetric

105. Let A = {1, 2, 3} and R = {(1, 1), (2, 2)}. Is the relation R antisymmetric?

Ans. (yes) it is antisymmetric.

106. Let A = {4, 5, 6} and R = {(4, 4), (4, 5), (5, 4), (5, 6), (4, 6)}. Is the relation R antisymmetric?

Ans. No , it is not antisymmetric.

107. Let A = {1, 2, 3} and R = {(1, 2), (2, 1), (1, 1), (2, 2)}. Is the relation transitive?

Ans. True

108. Let A = {1, 2, 3, 4} and R = {(1, 1), (1, 3), (2, 2), (2, 4), (3, 1), (3, 3), (4, 2), (4, 4)}. R is an Equivalence Relation.?

Ans. not equivalance

109. A Poset in which every pair of elements has both a least upper bound and a greatest lower bound is termed as _______

Ans. **Lattice**

110. ______ and _______ are the two binary operations defined for lattices.

Ans. Join and meet.

111. A ________ lattice has a greatest element and a least element which satisfy 0<=a<=1 for every a in the lattice(say, L).

Ans. Bounded lattice.

112. What is maximum element of poset?

Ans. Maximal element is an element of a POSET which **is not less than any other element of the POSET**

113. What is minimal element of poset?

Ans. Minimal element is an element of a POSET which **is not greater than any other element of the POSET**

114. What is Least Upper Bound?

Ans. The Least Upper Bound (LUB) is the smallest element in upper bounds. For example: **7 is the LUB of the set {5,6,7}**. The LUB also called supermun (SUP), whihc is the greatest element in the set. LUB needs not be in the set.

115. what is greatest lower bound?

Ans. a lower bound that is greater than or equal to all the lower bounds of a given set: 1 is the greatest lower bound of the set consisting of 1, 2, 3

116. What is meet semi lattice?

Ans. a join-semilattice is a partially ordered set that has a join for any nonempty finite subset. Dually, a meet-semilattice is a partially ordered set which has a meet for any nonempty finite subset. Every join-semilattice is a meet-semilattice in the inverse order and vice versa.

117. What is join semi lattice?

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118. What is the condition for a poset to be a lattice?

Ans. A poset is called a **complete lattice if all its subsets have both a join and a meet.**

119. What is complement of an element in a lattice?

Ans.

120. What is distributive lattice?

Ans. a distributive lattice is a lattice in which the operations of join and meet distribute over each other. The prototypical examples of such structures are collections of sets for which the lattice operations can be given by set union and intersection.

UNIT – III (Soumitra Sharma)

1.Which property must be satisfied for a set to be algebraic structure?

Ans- A non empty set A is called algebraic structure with respect to a binary operation if a*b €A for all values of a,b €A.

2. Which property must be satisfied for a set to be a semi group?
Ans- An algebraic structure (A,*) is called semi group if it follows the associative property. (a*b)*c=a*(b*c) for all values of a,b,c belongs to A. Here * is a binary operation.

3. Which properties must be satisfied for a set to be a monoid?
Ans- If an algebraic structure satisfies the associativity and if their exist an identity element (e). That is a*e=a.

For example a*1=a. and a+0=a

4. Which property must be satisfied for a set to be a group?
Ans- (A,*) is a group if

- A is closed.
- A is associative.
- Their exists an identity element(e).
- Their must be inverse of each element that is a*a^-1=e.

5. Which property must be satisfied for a set to be an abelian group?
Ans- Set is an abelian group we must satisfy the following five properties that is Closure Property, Associative Property, Identity Property, Inverse Property, and Commutative Property.

6. if a set satisfies only Closure property it is called Ans- Algebraic Structure.

7. if a set satisfies Closure and associative property it is called Ans- Semi group.

8. if a set satisfies Closure, Associative and Identity property it is called Ans- Monoid.

9. if a set satisfies Closure, Associative, Identity and inverse property it is called Ans- Group.

10. Name the 5 properties for a set to be abelian group
Ans- Closure Property, Associative Property, Identity Property, Inverse Property, and Commutative Property.

11. What is identity property?
Ans- An identity property is a property that applies to a group of numbers in the form of a set. It is named identity property because when applied to a number, the number keeps its ‘identity.’

12. What is inverse property?

Ans- Consider a non-empty set A, and a binary operation * on A. Then the operation is the inverse property, if for each a ∈A,,there exists an element b in A such that a * b (right inverse) = b * a (left inverse) = e, where b is called an inverse of a and e is an identity element.

13. What is closure property?

Ans- In a set A if a*b €A for all values of a,b €A. Then set A satisfies the closure property.

14. What is associative property?

Ans- If in a set A if (a*b)*c=a*(b*c) for all values of a,b,c belongs to A. Then it satisfies the associativity property Here * is a binary operation.

15. A monoid is called a group if _______

Ans- A monoid(B,*) is called Group if to each element there exists an element c such that (a*c)=(c*a)=e. Here e is called an identity element and c is defined as the inverse of the corresponding element.

16. A group (M,*) is said to be abelian if ___________ Ans- If it satisfies the commutative property that is x*y=y*x.

17. What is commutative property?

Ans- For a set A if x*y=y*x then A satisfies the commutative property. Where x,y belongs to A.

18. A cyclic group is always ________

Ans- A cyclic group is always an abelian group.

19. a*H=H*a relation holds if

Ans- H is **subgroup of an abelian group.**

20. a*H is a set of which coset?

Ans- (a * H) is the set of **a left coset of H in G** .

21. What is generator in cyclic group?

Ans- In a set A there is an **element g**, such that every other element of the group can be written as a power of g. This element g is the generator of the group.

22. What is cyclic group?

Ans- A group where there exist a generator is called a cyclic group.

23. What is ring?

Ans- An algebraic structure (A,+,*) is said to be a ring if:

- (A,+) should be an abelian group.
- (A,*) should be monoid.
- (*)should be distributive over first operation(+).

24. What is field?

Ans- An algebraic structure (A,+,*) is said to be a field if:

(A,+) should be abelian group.

(A,*)-(e) is an abelian group.

25. What are the conditions for a group to be a ring?

Ans-

- (A,+) should be an abelian group.
- (A,*) should be monoid.
- (*)should be distributive over first operation(+).

26. What is subgroup?

Ans-A subgroup is a subset of group elements of a group. that satisfies the four group requirements. It must therefore contain the identity element.

27. eH=He=H, True or false

Ans-

28. No of elements in coset are(order of subgroup)

Ans- Number of elements in coset is equal to number of elements in subgroup from which coset is generated.

29. What is order of element?

Ans- The order of an element in a group is the smallest positive power of the element which gives you the identity element.

30. What is the order of an identity element?

Ans- By definition, the order of the identity, **e, is one**, since $e^1 = e$.

31. What is Semi group?

Ans- An algebraic structure (A,*) is called semi group if it follows the associative property. (a*b)*c=a*(b*c) for all values of a,b,c belongs to A. Here * is a binary operation.

32. What are the properties that are to be satisfied by a relation to be an ablien group?

Ans- Set is an abelian group we must satisfy the following five properties that is Closure Property, Associative Property, Identity Property, Inverse Property, and Commutative Property.

33. Is it compulsorry for an ablien group to be reflexive or not ?

Ans- To satisfy the closure property abelian group must be reflexive.

34. Is a set of integer along with + operator i.e. (Z,+) satisfies all the properties required for an ablien group or not ?

Ans- Yes, it satisfies the all properties of abelian group.

35. When we call a ring as a ring with 0 divisor?

Ans- A ring R is said to be a ring with zero divisors if there exist a,b belongs to R such that a≠0 and b≠0 yet a.b=0

36. Define a Ring .

Ans- An algebraic structure (A,+,*) is said to be a ring if:

- (A,+) should be an abelian group.
- (A,*) should be monoid.
- (*)should be distributive over first operation(+).

37. A non empty set is said to be an algebraic structure with respect to unary , binary , ternary which type of operation.

Ans- A non empty set A is called an algebraic structure w.r.t binary operation.

38. Which type of property does matrix multiplication holds?

Ans- Associative property of multiplication-> A.(BC)=(AB).C

Distributive property of multiplication->A(B+C)=AB+AC (B+C)A=BA+CA

Multiplicative identity property->IA=AI

Multiplicative property of zero->OA=AO

Dimension property: The product of an m\times nm×nm, times, n matrix and an n\times kn×kn, times, k matrix is an m\times km×km, times, k matrix.

39. Is cyclic group always be an ablien group or not?

Ans- cyclic group is **an abelian group**.

40. Is every ablien group can be considered as a cyclic group?

Ans- **All cyclic groups are Abelian**, but an Abelian group is not necessarily cyclic.

41. Singular element is responsible to generate which type of group? Ans- Singular element is responsible to generate cyclic group.

42. Which type of group is this :- {1,-i,i,1}

Ans- Abelian group;

43. A function is define by f(x)=2x and f(x+y)=f(x)+f(y) is called .

Ans- Isomorphic.

44. How we can call a group i.e. onto itself as an isomorphic?

Ans- **An automorphism** is defined as an isomorphism of a group onto itself.

45. What we call a set which is representing all cosets?

Ans- A set of representatives of all the cosets is called **a transversal**.

46. If a group has order 8 then how many non isomorphic groups can be obtained through it . Ans- Five.

47. What is the multiplicative identit of natural numbers?

Ans- 1

48. If X is an idempotent non singular matrix then X must be an :
Ans- Since X is idempotent, we have X^2=X. As X is nonsingular, it **is invertible**.

49. When the sum of the elements in each row of NxN matrix is 0 then the matrix is .
Ans- If the Sum of Entries in Each Row of a Matrix is Zero, then the Matrix is **Singular**.

50. A semi group S that has an identity is called as .
Ans- A semigroup with an identity is called **a monoid**.

51. A group is also a semigroup , but can a semigoup always be an ablien group? Ans- No.

52. If an element a is said to be idempotent then it means.
Ans- An element 'a' of a set S equipped with a binary operator • is said to be idempotent under • **if**. **a • a = a**.

53. a*H =H*a a relation holds if
Ans- H is subgroup of an abelian group.

54. A set of all non singular matrices form a group under multiplication . is it true or false. Ans- The set of all matrices **doesn't form a group under multiplication.**

55. A relation (34*78)*57 =57 *(78*34) is satisfying which property? Ans- Associativity property.

56. If a group has total 65 elements and it has two sub groups with the order 14 and 30 then what is the order of the group formed from the intersection of both the subset ? Ans- 5

57. GCD(a,b)=GCD(b, aMod b) , is it true or not .
Ans- True.

58. A Modular arithmetic (a/b)= b (a^-1) is true ?
Ans- False.

59. if +abxab , aabaaa, bbabab are true the relation (S, +,*) where S=(a,b). then Can S be called as Ring.
Ans- Yes.

60. A set of all real number under the normal multiplication operator is not a group because Ans- . A set of all real number under the normal multiplication operator is not a group because zero has no inverse.

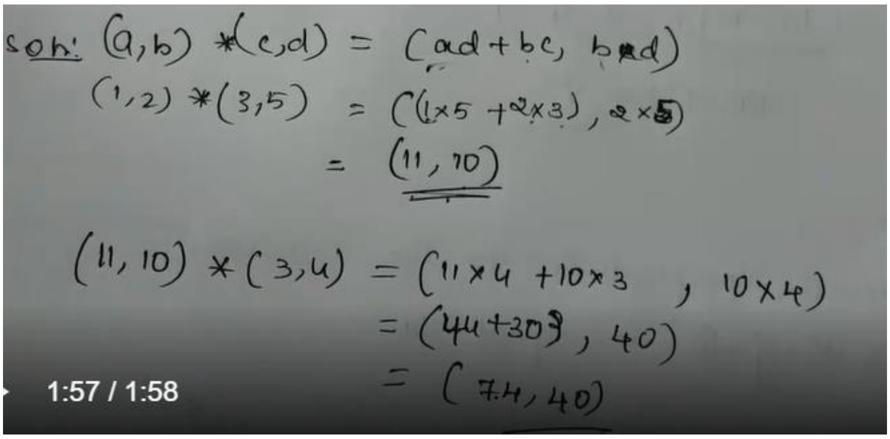
61. The inverse of -i in multiplicative group(1,-1,i,-i) is : Ans- The inverse of –i is i.

62. if (G,.) is a group such that (ab)2= a2b2 where a& b belongs to G, then G is an ablien group is it true or not .

Ans- True.

63. If the binary operation * is denied on ordered pair of real numbers as (a,b) *(c,d)= (ad + bc, bd) and is associative then(1,2)*(3,5) * (3,4) is equals to :-

Ans-



64. An algebraic structure (P,*) is a semi group or not .

Ans- An algebraic structure (P,*) is called a **semigroup** if a*(b*c) = (a*b)*c for all a,b,c belongs to S

65. When a monoid will become a group ?

Ans- A monoid will become a group when their must exist an inverse of each element.

66. if (G,.) is a group such that (ab)-1= a-1b-1 where a& b belongs to G, then G is an ablien group is it true or not .

Ans- True.

67. Matrix multiplication represents which type of property?

Ans- Associative property of multiplication-> A.(BC)=(AB).C

Distributive property of multiplication->A(B+C)=AB+AC (B+C)A=BA+CA

Multiplicative identity property->IA=AI

Multiplicative property of zero->OA=AO

Dimension property: The product of an m\times nm×nm, times, n matrix and an n\times kn×kn, times, k matrix is an m\times km×km, times, k matrix.

68. Is (1,i,-i,-1) set a cyclic group?

Ans- Yes.

69. If A(1,2,3,4) , Let ~={(1,2),(1,3),(4,2)} then ~ is :- Ans- Transitive

70. if (G,+) is a group such that (ab)2= a2b2 where a& b belongs to G, then G is an ablien group is it true or not .

Ans- True

71. The inverse of -i in additive group(1,-1,i,-i) is i or not Ans- True.

72. Is every group is a monoid statement if true or false ?
Ans- True

73. if (G,+) is a group such that (ab)-1= a-1b-1 where a& b belongs to G, then G is not an ablien group Ans- False it is an abelian group.

74. if (G,+) is a group such that (ab)5= a+5b+5 where a& b belongs to G, then G is an ablien group is it true or not .
Ans- False

75. A set of all possitive integers under the normal multiplication operator is a group .
Ans- The set of integers under multiplication **is not a group** it does not have the INVERSE PROPERTY.

76. A set of all possitive integers under the normal multiplication operator for being a group what all properties it must satisfied.
Ans-(A,*) is a group if

- A is closed.
- A is associative.
- Their exists an identity element(e).
- Their must be inverse of each element that is a*a^-1=e.

77. How many properties are to be satisfied by an ablien group? Name them .
Ans- Closure Property, Associative Property, Identity Property, Inverse Property, and Commutative Property.

78. if a group dissatisfies the distributive property then can it be considered as a ring ? Ans- No.

79. What all the properties a ring must satisfies to be a field?
Ans- An algebraic structure (A,+,*) is said to be a field if:

(A,+) should be abelian group.

(A,*)-(e) is an abelian group.

80. If n is the smallest possitive integer that satisfies a^n=e. then what is n here ? Ans- n is order.

81. Is set of all integer over the + operator is considered as a monoid. Ans- True.

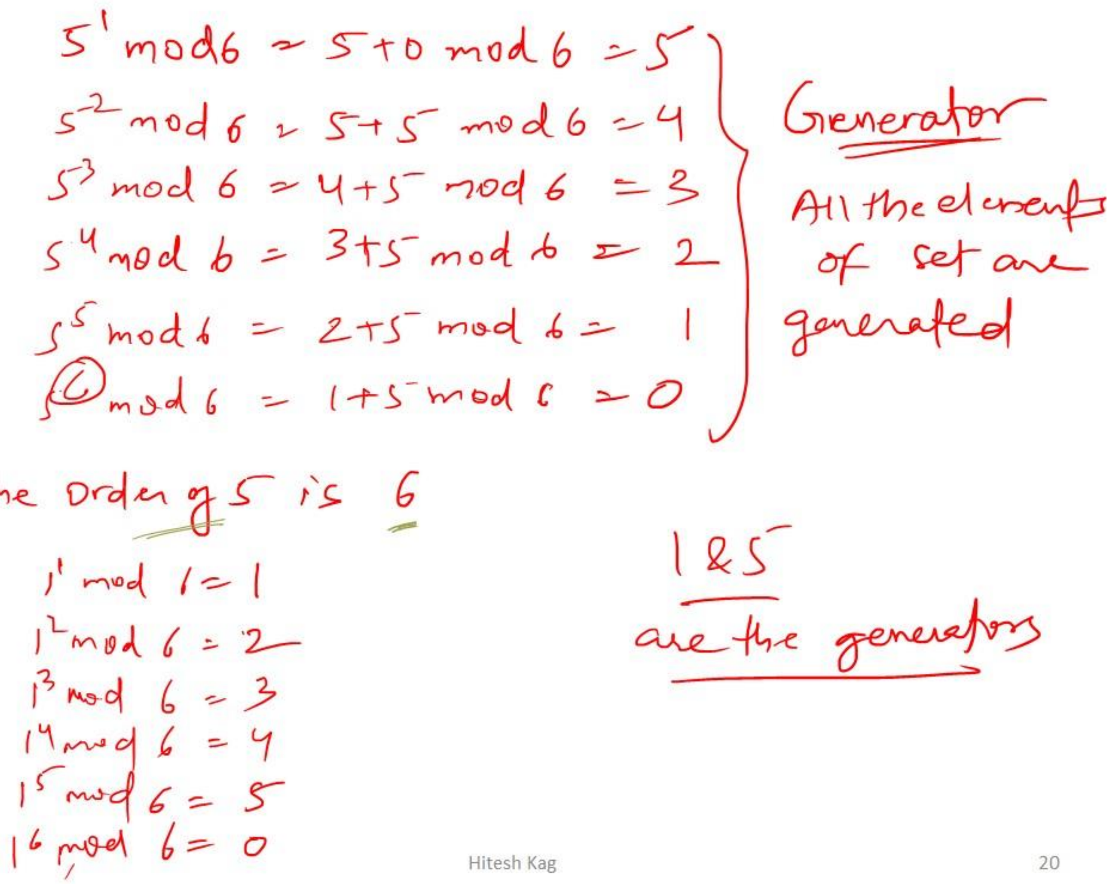
82. Given set (2,4,8,16) what will be the genarator element?
Ans- 2

83. H*a is a set of which coset?

Ans- Right coset.

84. What is H in an ablien group ?
Ans- Subgroup.

85. Define Generator element with an example.
Ans- In a set A there is an **element g**, such that every other element of the group can be written as a power of g. This element g is the generator of the group.
For example let A={0,1,2,3,4,5)



86. Is a set of Z and Z mod n is a cyclic group or not ?
Ans- For every positive integer n, the set of integers modulo n, again with the operation of addition, forms a finite cyclic group, denoted Z/nZ.

87. If a^2= a*a=a is true, then what a represents here?
Ans- 'a' is a idempotent.

88. Is a set of natural numbers with + operator can be an ablien group?
Ans- The set of natural numbers under **addition is not a abelian group**, because it does not satisfy all of the group PROPERTIES: it does not have the IDENTITY PROPERTY.

89. Is a set of natural numbers with + operator can be an algebraic structure or not? Ans- Yes it can be considered as an algebraic structure.

90. Is a set of real number satisfing the associative property ?
Ans- Yes

91. Set S(2,4,6,8.....) set of even number along with the operator + can be a group ? Ans- Yes it can be considered as group.

92. Ring (R,+,*) must satisfies the associative property, state whether it is true or false Ans- False.

93. To be a ring is it mandatory for the relation to be an ablien group?
Ans- True

94. Define idempotent element .
Ans- An element x of a group G is called idempotent **if x ∗ x = x**.

95. What do you understand by term closure?
Ans- if a*b €A for all values of a,b €A. Then A is satisfies the closure property.

96. Define Inverse property
Ans- Consider a non-empty set A, and a binary operation * on A. Then the operation is the inverse property, if for each a ∈A,,there exists an element b in A such that a * b (right inverse) = b * a (left inverse) = e, where b is called an inverse of a and e is an identity element.

97. Why a set of odd number along with + operator cannot form an ablien group ?
Ans- Because set of odd number does not satisfy the property of closure that is why set of odd numbers along with + operator cannot form an abelian group.

98. If I b the Identity element and A be any element of the given set and AI=IA , then what is AI?
Ans- Monoid
99. When a set is considered as a monoid?
Ans- - If an algebraic structure satisfies the associativity and if their exist an identity element (e). That is a*e=a.

For example a*1=a. and a+0=a

100. If in a given group its element's product is also included then what does this statement represents?
Ans-

101. What do you understand by the commutative property?
Ans- For a set A if x*y=y*x then A satisfies the commutative property. Where x,y belongs to A.

102. Why a Set of Natural numbers along with + operator cannot be a group ?
Ans- The set of natural numbers under addition is not a group, **because it does not satisfy all of the group PROPERTIES**: it does not have the IDENTITY PROPERTY

103. Why the set of integers over the operator * is not a group ?

Ans- The set of integers under multiplication is not a group, **because it does not satisfy all of the group PROPERTIES**: it does not have the INVERSE PROPERTY

104. Among the various number system who are eligible to be a valid Ablien group? Ans- Set of real number with + operator.

105. A set of integer , real number and even number along with + operator are eligible to form a valid abilien group ?

Ans- Only the set of real number along with + operator are eligible to form a valid abelian group.

106. A set of Matrix along with * operator is fail to satisfy the inverse property . what does it means ?

Ans- It means that a set of matrix can not be a group.

107. There exist two matrices of order N*N i.e. A and B if we are taking A+B then the resultant matrix is a valid group .

Ans- True

108. When a set will considered as a valid group?

Ans- (A,*) is a group if

- A is closed.
- A is associative.
- Their exists an identity element(e).
- Their must be inverse of each element that is a*a^-1=e.

109. if AA' = A'A =I where A is the element of a set and A' is its inverse, then what does it represents? Ans- It represents that set satisfies the inverse property.

110. If a set S (1,2,3,4,5,6) is satisfying the associative property along with * operator and 30 will be the product of a &b .What is the value of a & b?

Ans- If value of a is 5 then value of b is 6.

If value of a is 6 then value of b is 5.

111. If a set S (1,2,3,4,5,6) is satisfying the associative property along with * operator. What we will call (3,4)?

Ans- Semi-Group

112. A set S(2,4,6,8....) with + operator satisfying the condition (2+4)+6= 2+ (4+6), then (2,4,6,8) is considered as :-

Ans- Not Semi- Group

113. A set S(2,4,6,8.....) with * operator satisfying the condition (2*4)*6= 2* (4*6), then (2,4,6,8) is not considered as semi group why?

Ans- State (2, 4, 6, 8) is not a Semi group because it is not a algebraic structure as it does not follow the closer property.

114. What is Commutative Property is also called?

Ans- This property is also called **the order property of multiplication**. Commutative property only applies to multiplication and addition.

115. What is grouping property of multiplication?

Ans- Associative property.

116. What is associative and distributive properties?

Ans- The **associative property** states that when adding or multiplying, the grouping symbols can be rearranged and it will not affect the result. This is stated as (a+b)+c=a+(b+c)(a+b)+c=a+(b+c). The **distributive property** is a multiplication technique that involves multiplying a number by all of the separate addends of another number. This is stated as a(b+c)=ab+aca(b+c)=ab+ac.

117. Properties of group under group theory.

Ans- (A,*) is a group if

- A is closed.
- A is associative.
- Their exists an identity element(e).
- Their must be inverse of each element that is a*a^-1=e.

118. Why group theory is important?

Ans- group theory is **the study of symmetry**. When we are dealing with an object that appears symmetric, group theory can help with the analysis.

119. Where group theory is used in real life?

Ans- Perhaps a most prominent example of an application of group theory (a la symmetry study) in real life is **for the study of crystals**.

120. How Matrices are related to group theory?

Ans- In mathematics, a matrix group is a group G **consisting of invertible matrices over a specified field K, with the operation of matrix multiplication**.

UNIT – IV (Lavanya)

I	Every Isomorphic graph must have________ represen tation.	solved
2	What is the minimum number of edges needed to generatee the connectivity in a simple graph with 10 vertices?	By the formula n(n-1)/2 E = 45
3	What is a chromatic index?	solved
4	A minimal spanning tree of graph G is	solved
5	A graph contains 21 edges & 3 vertices of degree 4 & all the other vertices of degree 2. Find out the total number of vertices.	solved
6	A graph has 24 edges & degree of each vertex is K then which of the following is possible no. Of vertices.	solved
7	Minimum no. of vertices possible in a simple graph with 41 edges & degree of each vertex is at most 5.	16
8	How many simple nonisomorphic graph are possible when number of vertices are 3?	solved
9	How many simple nonisomorphic graph are possible when number of vertices are 5 & edges are 3?	4
10	Let G be a planar graph with v=10, E=9 & three are components then number of possible regions R are?	solved
I l	Maximum number of regions R are possible in a simple planar graph with 10 ed es are?	solved

12	a simple graph is	A simple graph is a graph that does not have more than one edge between any two vertices and no edge starts and ends at the same vertex
13	What is the number of edges present in a complete graph having n vertices?	(n*(n-1))/2

14	Vertices with maximal eccentricity is called	The maximum eccentricity from all the vertices is considered as the diameter of the Graph G. The maximum among all the distances between a vertex to all other vertices is considered as the diameter of the Graph G.
15	A connected planar graph having 6 vertices, 7 edges contains ____________re ions.	By formula e- 2+r It contains 3 regions
16	If a simple graph G, contains n vertices and m edges, the number of edges in the Graph G'(Complement of G) is	The union of G and G' would be a complete graph so, the number of edges in G'= number of edges in the complete form of G(nC2)edges in G(m). So (n*n-n-2*m)/2
17	A simple graph not hold?	A simple graph maybe connected or disconnected.
18	What is the maximum number of edges in a bipartite graph having 12 vertices?	solved
19	What is graph?	a mathematical object consist of a set of 1. V - NODES (VERTICES, POINTS), 2. E - EDGES BETWEEN PAIR OF NODES
20	What must be the ideal size of array if the hei t of tree is 'h'?	2^{A}h - 1
21	What is the parent for a node 'w' of a complete binary tree in an array representation when w is not 0?	Floor of w-1/2 because we can't miss a node
22	Maximum number of node in complete binary tree of height 5 and root is at hei ht 0.	By formula 2^{h} -1 So ans is 63
23	A connected planar graph having 10 vertices, 15 edges contains how may bounded re ions.	solved

24	Every Isomorphic graph must have________ represen tation.	adjacency matrix representation
25	A complete n-node graph Kn is planar if and only if	Any graph with 4 or less vertices is planar, any graph with 8 or less edges is planar and a complete n-node graph Kn is planar if and only if n 4.
26	A 4- regular graph have 10 edges. The number of vertex in the a h is	solved
27	If G is simple graph with 15 edges and complement of G has 13 edges then how man vertex in G	solved
28	A 3- regular graph have 8 vetex . The number of Ed es in the a is	solved
29	A non directed graph contain 16 edges and all vertices are of dgree 2, then the number of vertex in G is	solved
30	The_______of a graph G consists of all vertices and ed es of G.	eulerian circuit
31	A ______in a graph G is a circuit which consists of every vertex (except first/last vertex) of G exactl once.	Hamiltonian path
32	A graph with no edges is known as Empty graph. Empty graph is also known as	Empty graph is also known as trivial graphs
33	A graph G is called a ____________. If it is a connected acyclic ra h.	a Tree
34	In a graph if e=(u,v) means	u is adjacent to v but v is not adjacent to u.
35	A graph with n vertices will definitely have a parallel edges or self loop if the total number of edges are'?	A graph with n vertices will definitely have a parallel edge or a self loop if the total number of edges are greater than n—l.
36	A vertex of a graph G is called even or odd de endin u on	the vertex of a graph is called even or odd based on its degree.

37	A continuous non intersecting curve in the plan whose origin & terminus coincide	jordan graph
38	A graph with n vertices will definitely have a parallel edge or self loop of the total number of edges are	A graph with n vertices will definitely have a parallel edge or a self loop if the total number of edges are greater than n—l.
39	The maximum degree of any vertex in a simple graph with n vertices is	n-1
40	Circle has___________	no vetices
41	A graph is tree if and onl if	A graph is a tree if and only if there is exactly one path between every pair of its vertices
42	The complete graph with 4 vertices has k de rees where k is	3
43	Length of the walk of a ra h G is	The total number of edges covered in a walk is called as Length of the Walk.
44	The number of leaf nodes in a complete binar tree of de th d is	
45	An undirected graph possesses an eulerian circuit if and only if it is connected & it's vertices are	An undirected graph has an Eulerian path if and only if it is connected and has either zero or two vertices with an odd degree. If no vertex has an odd degree, then the graph is Eulerian.
46	In an undirected graph the number of nodes with odd degree must be	even
47	Eccentricity of a vertex is denoted by e(v) is defined b	max { d(u,v): u belongs to v, u does not equal to v : where d(u,v) is the distance between u&v)
48	If some positive integer k, degree of vertex d(v)=k for every vertex v of the graph G, then G is called	K - regular graph
49	Consider undirected random graph of eight vertices & edges between pair of vertices is 1/2. What is the expected number of unoredered cycles of length three?	solved

50	Let G be an undirected complete graph on n vertices, where n>2. Then, the number of different Hamiltonian cycles in ra h G is e ual to	(11-1)! / 2
51	In a connected graph, a bridge is an edge whose removal disconnects a graph. Which of the statements is true?	bridge cannot be part of a simple cycle
52	An ordered n-tuples (dl,d2,d3,......dn) and d1>=d2>=d3>= >=dn is called graphics, if there exists a simple undirected graph with n vertices having degree dl,d2,d3, dn respectively. Which of the following 6tuples is not ra hics?	<3, 3, 3, 1, 0, 0> is not graphic.
53	A cycle on n vertices is isomorphic to it's complement. The value of n is	5
54	Let grapg G=(V,E) be a directed graph where V is set of vertices & E is set of edges. Then which one of the following graph has the same strongly connected components as a h G	G2 = (V, E2) where E2 = v) I (v, u) e E}
55	The number of edges in a regular graph of de ree d & n vertices is	nd/2
56	Let G be a connected planar graph with 10 vertices. If the number of edges on each face is three, then the number of edges in grapg G is	solved
57	A graph is self complementary if it is isomorphic to its complement. For all self complementary graph on n vertices, n is	Congruent to 0 mod 4, or 1 mod 4

58	Consider an undirected graph G where selfloops are not allowed. The vertex set of G is {(i,j):1<=i<=12 & 1<=j<=12}. There is an edge between (a,b) and (c,d) if & lb- The number of edges in this graph is	506
59	How many edges will a tree consisting of N nodes have?	In order to have a fully connected tree it must have N-l edges
60	If x is a set and the set contains an integer which is neither positive nor negative then the set x is	Set is both Non- empty and Finite.
61	graphs are necessarily connected?	no
62	What is the minimum number of edges needed to generatee the connectivity in a simple graph with 10 vertices?	MIN edges = n-l So ans is 9 (doubt)
63	Minimum & Maximum number of edges are necessary in a simple graph with 10 vertices & 3components	The minimum number of edges in any simple connected graph is " n-l" for "n" vertices. But here you have 3 components then you need to divide it in 3 parts let it be ICIl=8, IC21=1 and IC3 these are the no. of vertices in the components. So Cl will have 7 edges(i.e. n-l) and other 2 will not have any edges so total 7 edges are here. You can divide the graph in any other way also the result will be same for 3 components. The maximum number of edges in any simple graph is nC2 so you see larger the value of "n" more the no. of edges. So for 3 components you can take at most 8 vertices in any one component and other 2 have only 1 vertex each and hence 8C2 will give 28 edges in the first component and other two components will have 0 edges. Therefor, there are total 28 edges maximum.
64	The Graph G be a graph with n vertices & k components. If we del a vertex in graph G then the number of components in graph G should be lie between.	Minimum: The removed vertex itself is a separate connected component. So removal of a vertex creates k-l components. Maximum: It may be possible that the removed vertex disconnects all components. For example the removed vertex is center of a star. So removal creates n-l components.
65	What is chordal?	, a chordal graph is one in which all cycles of four or more vertices have a chord, which is an edge that is not part of the cycle but connects two vertices of the cycle

66	Spanning trees can be created by removing how many edges from a c cle	by removing maximum e - n + 1 edges, we can construct a spanning tree.
67	Every Plannar graphs can be colored in at most colors	at most four colors
68	(I) Every regular graph is Plannar, (II) Every kRegular graph have euler circuit if k is even	1. false 2. false
69	Minimal Cut Set in any complete graph of n vertices have how many edges.	
70	Minimal Cut Set in any cycle graph of n vertices have how man ed es	
71	Every Isomorphic graph must have ________represe ntation.	adjacency matrix representation
72	A bridge can not be a art of	bridge cannot be part of a cycle
73	A graph G is called _____if it is connected c clic ra h	A graph G is called a Tree if it is a connected acyclic graph
74	(I) A connected graph cannot have isolated vertex (II) A disconnected graph should have pendant vertex true or false	I. false 2. true doubt
75	Maximum degree of a vertex in a cycle of n vertices	In a Cycle Graph, Degree of each vertex in a graph is two
76	(I) Every Bipartite graph is tree & Every tree is bipartite graph (II) If a graph has no cycle then it is bitartite raph	1. false 2. false
77	Cut set of a cycle of n vertices can have how man maximum ed es	the maximum number of cut edges possible is 'n-I'.
78	(I) In a graph, all the edges have same edge weights then minimum spanning tree cannot be unique. (II) Total Spanning tree of a K4 is 15	1. true 2. false

79	(I) There can be 2 centers in a tree (II) There can be two centers in cyclic ra h	1. true 2.
80	(I) A closed walk can not be cycle. (II) Euler circuit is a Trail	1. true 2. true
81	(I) Bridge can have more than one edge. (II) Matching number is lagest maximal matchin	1. true 2.false
82	A minimal spanning tree of graph G is	A minimum spanning tree or minimum weight spanning tree is a subset of the edges of a connected (un)directed edge-weighted graph that connects all the vertices together, without any cycles and with the minimum total edge weight possible
83	Consider a weighted undirected graph with positive edge weights and let (u,v) be an edge in the graph. It is known that the shortest path from source vertex s to u has 53 & shortest path from s to v has weight 65. Which statement is alwa s true	weight (u, v) 2 12
84	The complete graph k, has______ different s annin trees?	Spanning trees in complete graph is equal to n ^ (n-2)(where n is no of sides or regularity in complete graph).
85	n a connected graph, a bridge is an edge whose removal disconnects a graph. Which of the statements is true?	A bridge cannot be part of a simple cycle
86	A graph is self complementary if it is isomorphic to its complement. For all self complementary graph on n vertices, n is	Congruent to 0 mod 4, or 1 mod 4
87	a spanning tree of a graph G?	A spanning tree is a subset of Graph G, which has all the vertices covered with minimum ossible number of ed es.
88	Consider a complete graph G with 4 vertices. The graph G has _____ s annin trees.	A graph can have many spanning trees. And a complete graph with n vertices has n(n-2) spanning trees. So, the complete graph with 4 vertices
		has 4 ^ (4-2) = 16 spanning trees. advertisement

89	The travelling salesman problem can be solved usin	travelling salesman problem can be solved by contracting the minimum spanning tree
90	Consider a undirected graph G with vertices { A, B, C, D, E}. In graph G, every edge has distinct weight. Edge CD is edge with minimum weight and edge AB is edge with maximum weight. Then, which of the followin is false?	No minimum spanning tree contains AB
91	it is not the algorithm to find the minimum spanning tree of the iven ra h?	Bellman—Ford algorithm
92	How many nonisomorphic graphs are possible with 6 vertices and 6 edges and degree of each vertex is 2?	
93	Every isomorphic graph must have ________________ re resentation.	adjacency matrix representation
94	A cycle on n vertices is isomorphic to its complement. What is the value of n?	5
95	How many perfect matchings are there in a complete graph of 10 vertices?	So for n vertices perfect matching will have n/2 edges and there won't be any perfect matching if n is odd. For n=10, we can choose the first edge in IOC2 = 45 ways, second in 8C2=28 ways, third in 6C2=15 ways and so on. So, the total number of ways 45*28*15*6*1=113400. But perfect matching being a set, order of elements is not important and the permutations 5! of the 5 edges are same only. So, total number of perfect matching is 113400/5! = 945.
96	A complete n-node graph Kn is a planar if and onl if	Kn is planar if and only if n 4.
97	A graph is ______________if and only if it does not contain a subgraph homomorphics to K5 or K3,3	planar graph
98	An isomorphism of graphs G & H is a bijection if the vertex set of G & H. Such that any two vertices u & v of graph G are adjacent in graph G if and only if	f(u) and f(v) are adjacent in H

99	What is the grade of a planar graph consisting of 8 vertices & 15 edges? Hint:-2*no. Of ed es	If G is a planar graph with n vertices and m edges then r(G) = 2m i.e. the grade or rank of G is equal to the twofold of the number of edges in G. So, the rank of the graph is 2* 15=30 having 8 vertices and 15 edges.

100	A________________is a graph with no homomorphism to any proper sub ra h.	core
101	What is the difference between Graph and Tree	Root node Furthermore, one other major difference between tree and graph is that there is a root node in the tree while there are no root nodes in a graph. Loops Moreover, the presence of loops is another difference between tree and graph. There are no loops in a tree while there can be loops in a graph. Complexity Besides, a graph is more complex than a tree. Conclusion Tree and graph are two nonlinear data structures. The main difference between tree and graph is that a tree organizes data in the form of a tree structure in a hierarch while a a h or anizes data as a network.
102	Graphs can be .... and	Invalid Question
103	Graphs contains	verices and edges
104	Graphs can be tree but Tree cannot Graph, State True or False	false
105	Binary Tree contains two or more child node, State True or False	false
106	Always, Binary Tree contains two child node, State True or False	TRUE
107	Sometimes, Binary Tree contains less than two child node, State True or False	TRUE
108	Binary Tree and Binary Search Tree both are different, State True or False	TRUE
109	With the help of Binary Search Tree, we search particular item. State True or False	TRUE
110	If any edge having starting and ending point is same, it is called as	Closed walk

111	If any edges start and end with same pair of vertices then these two edges called as	adjacent
112	What is simple graph	a graph in which each edge connects two different vertices and where no two edges connect the same pair of vertices is called as simple graph
113	What is Multi Graph	graphs thay may have multiple edges connecting the same vertices are called multigraph
	What is Finite Graph	A graph with a finite number of nodes and edges
115	What is Infinite graph	A graph which has either an infinite number of edges or vertices is called an infinite graph.
116	In a complete graph every vertices is connected to	each vertex is connected to every other vertex of that graph
117	In a directed complete graph, if no. of vertices is 3 then no of ed es is	8
118	In a undirected complete graph, if no. of vertices is 3 then no of ed es is	4
119	Null graph contains zero edges, State True or False	TRUE
120	What are the types of sub- ra h	Edge disjoint subgraph and Vertex disjoint subgraph:

UNIT - 4

1. Adjacency matrix

2.

3. The minimum number of colors required for the edges of a given graph. is called as Chromati Index.

4. A Minimum spanning tree or minimum weight spanning tree is a subset of the edges of a connected (un) directed edge weighted graph that connects all vertices together, without any cycles.

5. We know that

$$2e = \Sigma \deg(v)$$

let no of vertices = n

so, $2 \times 21 = 3 \times 4 + 2(n-3)$

$42 = 12 + 2n - 6$

$42 - 6 = 2n$

$$\boxed{n = 18}$$

6. ATQ

No of vertices

$2 \times 24 = n\, K$

$47 = nK$

$n = 48/K$ — ①

Again, the maximum no of edges of a simple graph = $\frac{n(n-1)}{2}$ i.e $\frac{n(n-1)}{2} \geq 24$

$$n(n-1) \geq 48$$

the possible value of n which satisfies (i) are 48, 24, 16, 12, 8, 6, 4, 3, 2, 1 for $k = 1, 2, 3, 4, 6, 8, 12, 16, 24, 48$.

The value of n satisfies (ii) are 48, 24, 16, 12, 8, Hence required value of n are 48, 24, 16, 12, 8

—x—

7. ~~Solved~~

8. 4 non Isomorphic graphs

9.

10. $r = e - v + (k+1)$

$r = 9 - 10 + (3+1)$

$r = 9 - 6$

$r = 3$

11. In simple planer graph r is $>= 3$

so $3 \times |R| <= 2 \times |E|$

$3 \times |R| <= 20$

$|R| <= 6.67$

$|R| <= 6$ Ans

15. By Euler formula

$n - e = 2 - r$

$-1 = 2 - r$

$\boxed{r = 3}$

18. Maximum no of edges in bipartite =

$\frac{1}{4} \times n^2$

$\Rightarrow \frac{1}{4} \times (12)^2 = 36$

Ans 36.

23. By formula

$V - E + R = 2$

$R = 7$

Out of 7 faces one is an unbounded face, so total 6 bounded faces.

26. In 4-regular graph, degree = 4

$2E = N \times 4$

$2 \times 10 = N \times 4$

$\boxed{N = 5}$

27. Total edges = 28

for complete graph if n is vertices

$= \frac{n(n-1)}{2} = 28$

$\Rightarrow (n-8)(n+7) = 0$

Therefore, G has 8 vertices.

28. $E = \frac{nd}{2}$ so

$E = \frac{3 \times \cancel{8}^{4}}{\cancel{2}}$

$\boxed{E = 12}$

29 According To $2E = n \times d$

$n = \frac{\cancel{2} \times \cancel{16}^{8}}{\cancel{2}}$

$\boxed{n = 16}$

49.

A cycle of length 3 can be formed with 3 vertices. There can be total $^8C_3$ ways to pick 3 vertices from 8.

So expected no of unordered cycle of length 3 $= {^8C_3} \times \left(\frac{1}{2}\right)^3$

$= \frac{8 \times 7 \times 6}{3 \times 2 \times 1} \times \frac{1}{8}$

$\Rightarrow 7$

56. $\cancel{v = f}$.

$$v - e + f = 2 \quad \text{—— (i)}$$

$v \rightarrow$ vertices $\quad e =$ No of edges

$f =$ No of faces

A.T.Q $\rightarrow$ $v = 10$

And no of edges on each face is 3, Therefore, $2e = 3f$

In eqn (i)

$$10 - e + \frac{2e}{3} = 2$$

$$e = 24$$

UNIT – V (Tejas Shah)

Q1. What is recursive function?

Ans. The process in which a function calls itself directly or indirectly is called recursion and the corresponding function is called as recursive function.

Q2. What is recurrence relation?

Ans. A **recurrence relation** is an equation that defines a sequence based on a rule that gives the next term as a function of the previous term(s).

Q3. Write the recurrence relation for finding the factorial of the number?

Ans. Recall that factorial(n) = n × (n – 1) × (n – 2) × … × 2 × 1. The factorial function can be rewritten recursively as factorial(n) = n × factorial(n – 1).

Q4. Write the recurrence relation for finding the fibonacci series?

Ans.The recurrence relation for the Fibonacci sequence is Fn=Fn−1+Fn−2.Fn=Fn−1+Fn−2.

Q5. Write the recurrence relation for finding the Lucas Number?

Ans. Relation = $L_n = L_{n-1} + L_{n-2}$

Q6. Write the recurrence relation for finding the Padovan sequence?

Ans. Relation = P(n)=P(n-2)+P(n-3)

P(0)=P(1)=P(2)=1

Q7. Write the recurrence relation for finding Pell Number? Ans.
Relation =

$$P_n = \begin{cases} 0 & \text{if } n = 0; \\ 1 & \text{if } n = 1; \\ 2P_{n-1} + P_{n-2} & \text{otherwise.} \end{cases}$$

Q8. What is Base case in RR?

Ans. When you write a recurrence relation you must write two equations: one for the general case and one for the base case.

Q9. What is recursive case in recurrence relation?

Ans. The case in a recursive definition in which the method is calling itself.

Q10. Types of Recurrence Relation?

Ans. **First-Order Recurrences**

Nonlinear First-Order Recurrences

Higher-Order Recurrences

Q11. What is Homogenous Recurrence Relation?

Ans. The equation is said to be linear homogeneous Recurrence Relation equation if and only if R (n) = 0 and it will be of order n.

Q12. What is non-homogenous Recurrence Relation?

Ans. A recurrence relation is called non-homogeneous if it is in the form

$Fn=AFn-1+BFn-2+f(n)$ where $f(n)\neq 0$

Q13. Consider the following sequence: 1, 3, 9, 27, 81..

Ans. Invalid Question

Q14. What is generating function?

Ans. A **generating function** is a way of encoding an infinite sequence of numbers (a_n) by treating them as the coefficients of a formal power series.

Q15. What is generating function for the series 1,1,1,1,1…?]

Ans. the generating function of the sequence 1,1,1,1,1is $1+X+X^2+\ldots=$

$X_n= 1/1-x$

Q16. What is generating function for the series 1,-1,1,-1,1…

Ans. $X_n = 1/1+x$

Q17. What is generating function for the series 1,3,9,27…..

Ans. Xn=1/1-3x

Q18. What is generating function for the series 2,2,2,2….. Ans.

Ans. $X_n = 2/ 1-x$

Q19. What is generating function for the series 1,-1,1,-1,1…

Ans. $X_n = 1/1+x$

Q20. What is generating function for the series 2,4,10,28...... Ans.
$X_n = (1/1-x)+(1/1-3x)$

Q29. Find the value of a4 for the recurrence relation an=2an-1+3, with a0=6?
Ans. When n=1, $a_1=2a_0+3$, Now $a_2=2a_1+3$. By substitution, we get $a_2=2(2a_0+3)+3$. Regrouping the terms, we get $a_4=141$, where $a_0=6$.

Q30.

Q31. Consider the recurrence relation a1=4, an=5n+an-1. The value of a64 is _ Ans.
an=5n+an-1
= 5n + 5(n-1) + … + an-2
= 5n + 5(n-1) + 5(n − 2) +…+ a1
= 5n + 5(n-1) + 5(n − 2) +…+ 4 [since, a1=4]
= 5n + 5(n-1) + 5(n − 2) +…+ 5.1 – 1
= 5(n + (n − 1)+…+2 + 1) – 1
= 5 * n(n+1)/ 2 – 1 an
= 5 * n(n+1)/ 2 – 1
Now, n=64 so the answer is a64 = 10399.

Q32. What is the recurrence relation for 1, 7, 31, 127, 499?

Ans. $b_n=4b_{n-1}+3$

Q33. What is the solution to the recurrence relation an=5an-1+6an-2?

Ans. 6n

Can't be solved without options.

Q34. Determine the value of a2 for the recurrence relation an = 17an-1 + 30n with a0=3.
Ans. When n=1, $a_1=17a_0+30$, Now $a_2=17a_1+30*2$. By substitution, we get $a_2=17(17a_0+30)+60$. Then regrouping the terms, we get $a_2=1437$, where $a_0=3$.

Q35. What is counting principle?
Ans. The fundamental counting principle states that if there are p ways to do one thing, and q ways to do another thing, then there are p×q ways to do both things.

Q36. What is pigeonhole principle?

Ans. The **pigeonhole principle** states that if n items are put into m containers, with n > m, then at least one container must contain more than one item.

Q37. What is addition rule?

Ans. The addition rule for probabilities describes two formulas, **one for the probability for either of two mutually exclusive events happening and the other for the probability of two non-mutually exclusive events happening.**

Q38. What is multiplication rule?

Ans. The **multiplication rule** is a way to find the probability of two events happening at the same time (this is also one of the AP Statistics formulas). There are two multiplication rules. The general multiplication rule formula is: P(A ∩ B) = P(A) P(B|A) and the specific multiplication rule is P(A and B) = P(A) * P(B). P(B|A) means "the probability of A happening given that B has occurred".

Q39. Write 2 properties of permutation?

Ans. Permutations are employed for things of a diverse variety.
Indicates the arrangement of articles

Q40. Write 2 properties of Combinations?

Ans. Combinations are applied to things of a similar species.

It does not signify the arrangement of articles

Q41. Tell dearrangement theorem?

Ans. Mathematically, derangement refers to the **permutation consisting of elements of a set** in which the elements don't exist in their respective usual positions.

Q42. Tell principle of inclusion and exclusion

Ans. **counting technique that computes the number of elements that satisfy at least one of several properties while guaranteeing that elements satisfying more than one property are not counted twice**.

Q43. Determine the number of derangements of (2, 4, 6, 1, 3, 5) that end with integer 2, 4 and 6 in some order?

Ans. The place of 2, 4, 6 is specified i.e. each of them will get their place out of the last 3 places only. So 1, 3, 5 will automatically get one of the places in the first 3 places. This must ensure that 2, 4 and 6 occupies one of the last 3 places each and 1, 3 and 5 one of

1st 3 places each. Hence, 1, 3 and 5 can be arranged in 3! ways and 2, 4 and 6 also in 3! Ways. So, no of such derangements = 3! * 3! = 6 * 6 = 36.

Q44. A polygon has 44 diagonals. What is the number of its sides?

Ans. Number of diagonals = nC2 – n, where n is number of sides of polygon.
44 = [n(n-1)/2] – n n^2
– 3n – 88 = 0
Solving for n, we get,
n = 11, -8
We cannot take negative value here, so number of sides is equal to 11

Q45. How many parallelograms will be formed if 7 parallel horizontal lines intersect 6 parallel vertical lines?

Ans. For a parallelogram to be formed 2 horizontal and 2 vertical lines

7C2× 6C2= $= \frac{7!}{5! \times 2!} \times \frac{6!}{4! \times 2!}$

=21×15=315

Hence, the number of parallelogram =315

Q46. A teacher has to choose the maximum different groups of three students from a total of six students. Of these groups, in how many groups there will be included in a particular student?

Solution:

If students are A, B, C, D, E and F; we can have ${}^6C_3$ groups in all. However, if we have to count groups in which a particular student (say A) is always selected we would get ${}^5C_2$ = 10 ways of doing it.

Q47. How many four-digit numbers, each divisible by 4 can be formed using the digits 5, 6, 7, 8, 9, repetition of digits being allowed in any number

Ans. 125

Q48. There are seven pairs of black shoes and five pairs of white shoes. They are all put into a box and shoes are drawn one at a time. To ensure that at least one pair of black shoes are taken out, what is the number of shoes required to be drawn out? Ans.

Solution:

Find the number of white shoes:

Number of pairs = 5

Number of shoes = 5 x 2

Number of shoes = 10

Find the number of black shoes:

Number of pairs = 7

Number of shoes = 7 x 2

Number of shoes = 14

Consider the worst case scenarios:

All the white shoes were drawn before any of the black shoes were drawn.

Number of draws = 10

Now we are left with all the black shoes. All the left sides were drawn.

Number of draws = 7

Now whatever remains are all the right side of the black shoes. So any one draw from this stack will give us a pair.

Number of draws = 1

Find the total number of draws needed:

Total number of draws needed = 10 + 7 + 1

Total number of draws needed = 18

Answer: 18 draws are needed to ensure that there are at least one pair of black shoes.

Q49. How many 5 digit even numbers with distinct digits can be formed using the digits 1, 2, 5, 5, 4?

Ans. 36 is the digital even number with distinct digit can be formed using the digit 1,2,5,5,4.

Q50. İf C(n, 7) = C(n, 5), find n? Ans.

We know that C(n,r) = n! / r!(n - r)!

Now C(n,7) = C(n,5)

n! / 7! (n - 7)! = n! / 5! (n - 5)!

=> 5! (n - 5)! = 7! (n - 7)!

=> [5!] x [(n - 5)(n - 6)[(n - 7)!] = 7 x 6 x 5! x (n - 7)!

=> n^2 - 11n + 30 = 42

=> n^2 - 11n - 12 = 0

=> (n - 12)(n + 1) = 0

=> n = 12 or n = - 1

But n = - 1 is rejected as n is a non negative integer. Therefore, n = 12

Q51. if 18Cr = 18Cr+2 ; find rC5? Ans.

$^{18}C_r = {}^{18}C_{r+2}$

$\text{So, } r = r + 2 \text{ or } 18 - r = r + 2$

$\times \qquad 16 = 2r$

$r = 8$

$\text{So, } {}^{8}C_5 = \frac{8!}{5!3!} = \frac{6 \times 7 \times 8}{6} = 56.$

Hence, the answer is 56.

Q52. The number of circles that can be drawn out of 10 points of which 7 are collinear is? Ans.

A unique circle can be drawn from three non-collinear points

(1) Two points from collinear and one from non-collinear is ${}^{7}C_2 \times {}^{3}C_1 = 63$

(2) One point from collinear and two from non collinear is ${}^{7}C_1 \times {}^{3}C_2 = 21$

(3) Three non-collinear points is ${}^{3}C_3 = 1$

Then, the total number of circles drawn $= 63 + 21 + 1 = 85$.

Q53. How many rectangles can be formed out of a chess board ?

Ans. There are 1296 different rectangles on the chess board. 204
of these rectangles are squares.

Q54. How many natural numbers can be made with digits 0, 7, 8 which are greater than 0 and less than a million?

Ans. 728

Q55. A, B, C, and D are four points, any three of which are non-collinear. Then, the number of ways to construct three lines each joining a pair of points so that the lines do not form a triangle is?

Ans. 24

Q56. How many numbers can be formed from 1, 2, 3, 4, 5 (without repetition), when the digit at the unit's place must be greater than that in the ten's place? Ans. 60

Q57. There are 6 letters for 3 envelopes. In how many different ways can the envelopes be filled?

Ans. The 1st envelope can be filled up in 6 ways.
The 2nd envelope can be filled up in 5 ways and the 3rd envelope can be filled up in 4 ways.
Therefore, by the principle of association, the three envelopes can be filled up in 6 x 5 x 4 = 120 ways

Q58. From among the 36 students in a class, one leader and one class representative are to be appointed. In how many ways can this be done?

Ans. there are 36 Students and every one has equal chance of being selected as leader. hence leader can appointed in 36 ways, when one person is appointed as leader we are left with 35 students. =36*35=1260

Q59. In how many ways can a cricketer can score 200 runs with fours and sixes only? Ans.
200 runs can be scored by scoring only fours or through a combination of fours and sixes.Possibilities are 50 x 4, 47 x 4 + 2 x 6, 44 x 4 + 4 x 6 ... A total of 17 ways

Q60. Seven different objects must be divided among three people. In how many ways can this be done if one or two of them must get no objects?

Ans.381

Q61. From a group of 7 men and 6 women, five persons are to be selected to form a committee so that at least 3 men are there on the committee. In how many ways can it be done?

Ans.

There will be 3 cases for calculating the number of ways to form a committee is as follows

Case 1: 3 Men, 2 Women

For selecting 3 men out of 7 and 2 women out of 6 to form thee 5 people committee, we can use the formulas given in the hint as follows

$$= {}^{7}C_3 \times {}^{6}C_2$$
$$= 35 \times 15$$
$$= 525$$

Case 2: 4 Men, 1 Woman

For selecting 4 men out of 7 and 1 woman out of 6 to form thee 5 people committee, we can use the formulas given in the hint as follows

$$= {}^{7}C_4 \times {}^{6}C_1$$
$$= 35 \times 6$$
$$= 210$$

Case 3: 5 Men, 0 Women

For selecting 5 men out of 7 and 0 women out of 6 to form thee 5 people committee, we can use the formulas given in the hint as follows

$$= {}^{7}C_5 \times {}^{6}C_0$$
$$= 21 \times 1$$
$$= 21$$

Q62. In how many different ways can the letters of the word 'LEADING' be arranged in such a way that the vowels always come together?

Ans. The word 'LEADING' has 7 different letters.
When the vowels EAI are always together, they can be supposed to form one letter.
Then, we have to arrange the letters LNDG (EAI).
Now, 5 (4 + 1 = 5) letters can be arranged in 5! = 120 ways.
The vowels (EAI) can be arranged among themselves in 3! = 6 ways.
Therefore Required number of ways = (120 x 6) = 720

Q63. In how many different ways can the letters of the word 'CORPORATION' be arranged so that the vowels always come together?

Ans. 50400

Q64. Out of 7 consonants and 4 vowels, how many words of 3 consonants and 2 vowels can be formed?

Ans. 25200

Q65. In how many ways can the letters of the word 'LEADER' be arranged?

Ans. The word 'LEADER' contains 6 letters, namely 1L, 2E, 1A, 1D and 1R. ∴
Required number of ways
=6!(1!)(2!)(1!)(1!)(1!)=360

Q66. In a group of 6 boys and 4 girls, four children are to be selected. In how many different ways can they be selected such that at least one boy should be there?

Ans. 210

Q67. How many 3-digit numbers can be formed from the digits 2, 3, 5, 6, 7 and 9, which are divisible by 5 and none of the digits is repeated?

Ans. 20

Q68. In how many ways a committee, consisting of 5 men and 6 women can be formed from 8 men and 10 women?

Ans. 11760

Q69. A box contains 2 white balls, 3 black balls and 4 red balls. In how many ways can 3 balls be drawn from the box, if at least one black ball is to be included in the draw? Ans. 64

Q70. In how many different ways can the letters of the word 'DETAIL' be arranged in such a way that the vowels occupy only the odd positions?

Ans. 36

Q71. In how many ways can a group of 5 men and 2 women be made out of a total of 7 men and 3 women?
Ans.

Required number of ways = $({}^7C_5 \times {}^3C_2) = ({}^7C_2 \times {}^3C_1) = \left(\frac{7 \times 6}{2 \times 1} \times 3\right) = 63.$

Q72. How many 4-letter words with or without meaning, can be formed out of the letters of the word, 'LOGARITHMS', if repetition of letters is not allowed?

Ans. .${}^{10}P_4$=5040

Q73. In how many different ways can the letters of the word 'MATHEMATICS' be arranged so that the vowels always come together?

Ans. Number of ways of arranging these letters =8! / ((2!)(2!))= 10080.

Q74. In how many different ways can the letters of the word 'OPTICAL' be arranged so that the vowels always come together?

Ans. 720

Q75. There are 4 oranges, 5 apples and 6 mangoes in a basket. In how many ways can a person make a selection of fruits among the fruits in the basket?

Ans. 209

Q76. In how many ways can the letters of the word 'PARAGLIDING' be arranged such that all the vowels occur together?

Ans. 120960

Q77. Five people out of whom only two can drive are to be seated in a five seater car with two seats in front and three in the rear. The people who know driving don't sit together. Only someone who knows driving can sit on the driver's seat. Find the number of ways the five people can be seated?
Ans. 36

Q78. A boy is playing a Snake & Ladder game; he is on 91 and has to get to 100 to complete the game. There is a snake on 93 and 96. In how many ways he can complete the game, if he doesn't want to roll the dice more than three times.

Ans. Number of ways of seating remaining = 3! Hence, option D is correct. A boy is playing a Snake & Ladder game; he is on 91 and has to get to 100 to complete the game. There is a snake on 93 and 96.

Q79. 8 members are to be selected from a group of 9 males and 7 females. In how many ways will the members with at most 3 females and at least 4 males be selected? Ans.

Ans. 6435 ways

Q80. A chess board has rows and columns marked A to H and 1-8. Aman has a knight and a rook which he has to place on the board such that the two pieces are not in same row or column, what is total number of ways he can place the two pieces?

Ans. 3136

Q81. How many three letter words can be formed using the letters of the word "PRACTICES"? Ans. 357

Q82. Six students sitting in a row are given one toffee each from three types of toffees such that no two adjacent child gets same type of toffee. In how many ways can the toffees be distributed among the students?

Ans. 96

Q83. In how many different ways can the letters of the word “Thoughts” be arranged in such a way that the vowels always come together?

Ans. 2520

Q84. An objective test with all the questions mandatory to be answered can be attempted in 127 ways such that the student gets atleast one question right. Find the number of ways in which he can answer 4 questions correctly.

Ans. 35

Q85. A postmaster wants to get delivered 6 letters at six different addresses. In the post office there are 2 postmen then in how many ways can the postmaster send the letters at different addresses through the postmen?

Ans. 75%

Q86. In a school, there are two students: one boy and one girl. The class teacher distributes some number of books between the two students. If each student is eligible for any number of books then the number of ways the class teacher can distribute the books is 1024. Find how many books the class teacher has?

Ans. Each student is eligible for any number of books then let the number of books = x Therefore, $2^x=1024$ x=10=The number of books the class teacher has.

Q87. In a Job opening, 25 girls and 75 boys applied. The interviewer can select either a girl or a boy for the job. In how many ways the interviewer can make this selection?

Ans. $^{100}C_1$ = 100 ways

Q88. In a class there are 15 students. It was to divide in two groups, A and B. The number of students in group A should be 7 and the number of students in group B should be 8. In how many ways, groups can be formed? Ans.

The group A can be formed in,

$^{15}C_7$ ways = $\frac{15!}{(7! \times 8!)}$ = 6435 ways

Group B can be formed in $^{15}C_8$ ways = $\frac{15!}{(8! \times 7!)}$ = 6435 ways

The required number of ways = 6435 + 6435 = 12870 ways

Hence, option A is correct.

Q89. An examination consists of total 5 objective and 5 subjective questions. In how many ways, a student can solve 8 questions out of which 5 are objective and 3 are subjective? Ans. ${}^{5}C_{1}*{}^{5}C_{3}$

Q90. How many numbers are there in between 100 and 1000 such that exactly one of their digits is 3 if repetition is not allowed?

Ans. The number of ways to fill the unit's place =10 [by any digit from 0 to 9]. ∴ the number of such numbers =(1×10×10)=100. Hence, the total number of required numbers =(90+90+100)=280

Q91 In a room everybody shakes hands with everybody else. The total number of handshakes is 66. The total number of persons in the room is:

Ans 66

Q92 A shop has four types of fowlers namely - Tulip, Rose, Marigold and Lily. A person came in to buy 10 flowers such that he has at least one flower of each type. In how many ways can he do so, if the shop has sufficient amount of flowers of each type?

Ans. atleast one flower of each type.

so 1 tuplip 1 rose 1 marogold 1 lily =4 ways which is 1 way the rest 6 flowers can be picks as follows 6C4 =6*5*4*3/4*3*2*1 = 15

4*15=60

Q93 Twenty families, each comprising five members attend a wedding reception and exchanged a Diwali greetings card with every other person of a different family exactly once. Find the total number of card exchanges happening at the reception. Ans.

Q94 A volleyball team of 6 players is to be selected from a group of 8 male and 7 female players. In how many ways is the team selected such that at most two female players are there in the team.

Ans. ${}^{7}C_{2} * {}^{8}C_{4} + {}^{7}C_{1} * {}^{8}C_{5} + {}^{7}C_{0} * {}^{8}C_{6}$

Q95 A volley ball team of six players is to be selected from a group of 9 male players ‘x’ female players. Find the value of ‘x’, if the number of ways to select a team having exactly two female players is equal to 1890. Ans.

$$^9C_4 \times {}^xC_2 = 1890$$

$$\frac{9!}{4!\times 5!} \times \frac{x!}{2!\,(x-2)!} = 1890$$

$$\frac{9\times 8\times 7\times 6\times 5!}{4\times 3\times 2\times 5!} \times \frac{x\times(x-1)\times(x-2)!}{2!\times(x-2)!} = 1890$$

$$63\times(x^2-x) = 1890$$

$$x^2 - x = 30$$

$$x^2 - x - 30 = 0$$

$$x^2 - 6x + 5x - 30 = 0$$

$$x(x-6) + 5(x-6) = 0$$

$$(x+5)(x-6) = 0$$

$$x = 6, -5$$

Final ans $x = 6$

Q96 There are 5 English, 4 Hindi and 3 regional newspaper options available in a library. In how many ways the owner can subscribe to five newspapers such that there are at least two English and two Hindi newspapers?

Ans.

$$^5C_2\times{}^4C_2\times{}^3C_1+{}^5C_2\times{}^4C_3\times{}^3C_0+{}^5C_3\times{}^4C_2\times{}^3C_0$$

Q97 In how many ways the letters of the word “EXCITEMENT” can be arranged so that the distance between any two vowels is a multiple of 3?

Ans. There are a total of 10 letters - vowels = 4(E = 3, I = 1), consonants = 6 (T = 2, X = C = M = N = 1) If we put a vowel at 1st place the minimum distance to put second vowel is 4 (distance = 3), and the next at 7 and the next at 10, the distance between any two vowels is a multiple of 3.

No other placement of vowels can fulfill this condition.

The number of ways to arrange 4 letters in these 4 places = 4!

= 4 3!

The number of ways to arrange the remaining 6 consonants = 6!

2!

Total number of arrangements = 4 × 6! = 1440 2!

Hence, option C is correct.

Q98 Varun and Alia go to McDonald's. They both want to eat a meal which comprises of two burgers, one French fries, one cold drink and a dessert. There are 5 types of burgers, 2 types of French fries, 3 types of cold drinks and 5 types of desserts available. They will eat different burgers from each other and both the burgers in their meal will also be different, but they will have the same dessert. What is the number of ways in which they can place the order? Ans.

Number of burgers = 5, Fries = 2, cold drink = 3 and dessert = 5

No of possibilities

Item	Varun	Alia	Total	Total
Burgers	${}^5C_2$	${}^3C_2$	${}^5C_2 \times {}^3C_2$	30
French Fries	2	2	2×2	4
Cold Drinks	3	3	3×3	9
Dessert	5	1	5×1	5

Total number of possibilities = $30 \times 4 \times 9 \times 5 = 5400$
Hence, option B is correct.

Q99 In a singing reality show 8 boys and 4 girls are selected from auditions and they are to be divided into teams of three captains Shaan, Niti and Mika. Two particular girls will join only Niti's Team and rest of the two girls will not be together. In how many ways the participants can be divided into teams?

Ans. 2240

Q100 There are three rows with three seats in each row. Four boys and two girls are to be seated in these three rows such that girls always sit in the last row. In how many ways the students can be seated? Ans. 5040

Q101 Aana has 3 fifty rupee notes, 4 hundred rupee notes and 6 five hundred rupee notes in his pocket. If 2 notes are taken at random, what are the odds in favour of both notes being hundred rupee notes? Ans.

Total number of ways in which 2 notes can be taken from the pocket containing 13 notes is ${}^{13}C_2$ and the number of ways in which 2 hundred rupee notes can be taken is ${}^4C_2$.

The probability of choosing 2 hundred rupee notes = $\frac{{}^4C_2}{{}^{13}C_2}$

$= \frac{4 \times 3}{13 \times 12} = 1/13$

Odds in favour of an event = Number of favorable outcomes : Number of unfavorable outcomes

∴ The odds in favour of both the notes being hundred rupee notes are 1 : 12

Hence, option D is correct.

Q102 In how many different ways, the letters of the word 'CAPITA' can be arranged? Ans.

Number of arrangements = $\frac{n!}{r!}$

Where n = total number and r = number of letters who is repeated.

Total letters = 6, but A has come twice

So, required number of arrangements

$= \frac{6!}{2!} = \frac{6 \times 5 \times 4 \times 3 \times 2}{2!} = 6 \times 5 \times 4 \times 3 = 360$

Hence, option A is correct.

Q103 In how many different ways can the letters of the word "PATIENT" be arranged so that all the vowels come together?

Ans.

Total number of vowel = 3

Total number of consonants = 4

Three vowels can be arranged among themselves in 3! Ways.

P, T, N, T and (AIE) can be arranged in 5!/2! Ways.

Reqd. number of ways = $\frac{5!}{2!} \times 3! = 360$

Hence, option (C) is correct.

Q104 In how many different ways can the letters of the word 'OPTICAL' be arranged so that be the vowels always come together?

Ans.

The number of letters in the word OPTICAL is seven, in which three vowels (AIO) are considered as one.

∴ No. of ways 4 letters (PTCL) and group of three vowels which are considered as one letter can be arranged = 5!

and the no. of ways 3 vowels (AIO) can be arranged = 3!

∴ Total no. of ways = 5! × 3! = 720

Hence, option D is correct.

Q105 In how many different ways letters of the word "EDUCATION" can be arranged such that all the consonants come together?

Ans.

Number of consonants = 4

Consonants can be arranged among themselves in 4! Ways.

E, U, A, I, O and (DCTN) can be arranged in 6! Ways

Required number of ways = 6! × 4! = 720 × 24 = 17280

Hence, option (C) is correct.

Q106 In how many different ways can the letters of the word "MARRIAGE" be arranged such that all the vowels come together? Ans.

- Vowels are : A, I, A and E.

Vowels can be arranged among themselves in $\frac{4!}{2!}$ ways.

M, R, R, G and (AIAE) can be arranged in = $\frac{5!}{2!}$ ways.

Total number of ways = $\frac{5!}{2!} \times \frac{4!}{2!}$

= 60 × 12 = 720

Hence, option (A) is correct.

Q107 How many 3 - letter words with or without meaning, can be formed out of the letters of the word, 'LOGARITHMS', if repetition of letters is not allowed? Ans.

Six letter words with at least two vowels can have 2, 3, 4 or 5 vowels as no letters can be repeated.

There are 21 consonants and 5 vowels.

All possible cases:

2 vowels and 4 consonants

3 vowels and 3 consonants

4 vowels and 2 consonants

5 vowels and 1 consonant

∴ Number of ways in which this can be done = ${}^5C_2 \times {}^{21}C_4 + {}^5C_3 \times {}^{21}C_3 + {}^5C_4 \times {}^{21}C_2 + {}^5C_5 \times {}^{21}C_1$

= 10 × 5985 + 10 × 1330 + 5 × 210 + 1 × 21 = 74221

In each of these cases, chosen 6 letters can arrange themselves in 6! Ways.

∴ Total number of ways in which this can be done = 6! × 74221 = 720 × 74221 = 53439120

Hence, option B is correct.

Q108 In a badminton competition involving some men and women of a society, every person had to play exactly one game with every other person. It was found that in 36 games both the players were men and in 78 games both the players were women. Find the number of games in which one player was a man and other was a woman.? Ans.

Let the number of men be x and women be y

In badminton two person can play at a time,

Therefore, no of games played between men is ${}^xC_2=36$

$\frac{x(x-1)}{2} = 36$

$x(x-1) = 72$

$x = 9$

Which means total number of men playing badminton are 9

Now, no of games played between women is ${}^yC_2=78$

$\frac{y(y-1)}{2} = 78$

$y(y-1) = 156$

$y = 13$

Which means total number of women playing badminton are 13

Therefore, no of games in which one player is man and one is woman is,

${}^9C_1 \times {}^{13}C_1=117$

Q109 What is the difference between the number of ways when three consecutive letters of the word 'ALLAHABAD' is selected in which two letters are same and the number of ways when two consecutive letters of the word 'BANGALORE' is selected in which one letter is vowel while other is consonant? Ans.

From the word 'ALLAHABAD'-

Total cases = 'ALL', 'LLA', 'LAH', 'AHA', 'HAB', 'ABA' and 'BAD'

Required cases = 'ALL', 'LLA', 'AHA' and 'ABA'

Total required cases = 4

From the word 'BANGALORE'-

Total cases = 'BA', 'AN', 'NG', 'GA', 'AL', 'LO', 'OR' and 'RE'

Required cases = 'BA', 'AN', 'GA', 'AL', 'LO', 'OR' and 'RE'

Total required cases = 7

Difference = 7 – 4 = 3
Hence, option (B) is correct.

Q110 In how many different ways the letters of the word 'UGANDA' can be arranged such that 'G' always comes at first place and 'N' always comes at last place ? Ans.

Total letters = 6 (U, G, 2 A, N, D)

When G always comes at first place and N always comes at last place so we have 4 letters to arrange which can be arranged in 4! Ways. 'A' appears twice in the remaining 4 letters.

So, required number of ways = $\frac{4!}{2!} = 12$

Hence, option C is correct.

Q111 A five – letter word is to be formed from a group of 5 vowels and 4 consonants, using at least one vowel and at least one consonant. In how many ways the word having greater number of consonants than vowels can be formed? Ans.

Case I: 4 consonants and 1 vowel is there in the word

Number of ways = ${}^4_4C \times {}^5_1C = 1 \times 5 = 5$

Case II: 3 consonants and 2 vowels is there in the word

Number of ways = ${}^4_3C \times {}^5_2C = 4 \times 10 = 40$

So, total number of ways = 40 + 5 = 45

So option C is the correct answer.

Q112 A committee of 8 members is to be selected from a group of 12 male and 10 female members. In how many ways the committee is selected such that at most two and at least one male member are there in the committee? Ans.

Case I: Two male members in the committee
Number of ways to select the committee = ${}^{12}C_2 \times {}^{10}C_6 = 66 \times 210 = 13860$ ways

Case II: One male member in the committee
Number of ways to select the committee = ${}^{12}C_1 \times {}^{10}C_7 = 12 \times 120 = 1440$ ways

So, total number of ways = 13860 + 1440 = 15300 ways

Hence, option C is correct.

Q113 If a team of 4 persons is to be selected from 8 males and 8 females, then in how many ways can the selections be made to include at least 1 female Ans.

According to the given problem,

Total number of males = 8
Total number of females = 8

We need to select a team of 4 persons with atleast one female.

The possible combinations for a group of four person are :- 1 female and 3 males, 2 females and 2 males, 3 females and 1 male, 4 females and 0 male.

Therefore, ways in which selection can be made are = ${}^{8}C_1 \times {}^{8}C_3 + {}^{8}C_2 \times {}^{8}C_2 + {}^{8}C_3 \times {}^{8}C_1 + {}^{8}C_4 \times {}^{8}C_0$
= 448 + 784 + 448 + 70 = 1750

The important thing to note is that there should be at least 1 female in the group and at most 4 females can be there in the group of 4 persons.
Hence, option (C) is correct.

Q114 Find the number of ways in which mixed double tennis game can be arranged amongst 9 married couples if no husband and wife play in the same game Ans.

Let the husbands be h1, h2, h3.......h9 and wives be w1, w2, w3.......w9

Choosing 2 husband=${}^{9}C_2$=36

Choosing 2 wives = ${}^{7}C_2$=21 (Here we should have taken ${}^{9}C_2$, but as per the question no husband and wife can play in the same game, so we eliminated 2 wives of chosen husbands)

We know that in mixed double game, it is played as m1w1 vs m2w2.

So, out of 36 men and 21 women two arrangement is possible, either m1w1 vs m2w2 or m2w1 vs m1w2.

Therefore, total ways = 36 × 21 × 2 = 1512 ways

Hence, option (C) is correct.

Q115 A basketball team of 5 players is to be selected from a group of 10 men and 8 women players. A volley ball team of 6 players is to be selected from a group of 8 men and 7 women players. Find the difference in the number of ways in which both the teams are selected, given that each team has only 2 female players Ans.

Number of ways in which the basketball team is selected = ${}^{10}C_3 \times {}^{8}C_2$ = 120 × 28 = 3360

Number of ways in which the volleyball team is selected = ${}^{8}C_4 \times {}^{7}C_2$ = 70 × 21 = 1470

Required difference = 3360 – 1470 = 1890

Hence, option A is correct.

Q116 Four letters are selected from the word “CAPAME” and are rearranged to form four letter words. How many words can be formed?

Ans.

The given word has six letters A – 2, P -1, E – 1, C – 1 and M – 1

There are three cases,

Case 1: Both As are selected
Selection = selecting 2 letters out of remaining 4 = ${}^4C_2$

Arrangement = 4!/2!
Words possible = ${}^4C_2 \times 4!/2! = 72$

Case 2: Only one A is selected
Selection of three letters from remaining four letters = ${}^4C_3$

Arrangement = 4!
Words possible = ${}^4C_3 \times 4! = 96$

Case 3: No A is selected
Arrangement = 4! = 24

Total words possible = 72 + 96 + 24 = 192
Hence, option E is correct.

Q117 A, B, C, D and E sit on five chairs all of which are facing north. C will sit only on the leftmost chair and B will not sit anywhere to the left of A. In how many ways they can be seated? Ans.

C will sit on 1 and B will sit somewhere to the right of A

_1_ _2_ _3_ _4_ _5_

C will sit on 1

Then there are three possibilities

Case 1: A on 2, so B can be seated on 3, 4 or 5

Then remaining two can be seated on two chairs in 2 ways

Ways = 3 × 2 = 6

Case 2: A on 3, so B can be seated on 4 or 5

Ways = 2 × 2 = 4

Case 3: A on 4, so B will be on 5

Ways = 2

Total ways to they can sit = (6 + 4 + 2) = 12

Q118 Six boys and 4 girls are to be seated in two separate rows with five chairs each, such that two particular girls are always together and all the girls are not in the same row. In how many ways can they be seated? Ans.

Two girls will always be together

So first we select one row to seat these two girls, ways = 2

Now we can select two adjacent chairs in 4 ways and then girls can sit on them in 2 ways

Ways to seat these two girls = $2 \times 4 \times 2 = 16$

All the girls should not be together, so at least one girl should be in another row from the remaining two girls.

So from the remaining two girls we select one to be seated in second row, ways = 2

Now in the second row we select one chair out of five to seat the selected girl, ways = 5

Ways to seat third girl = $2 \times 5 = 10$

Now rest of the seven can be arranged in 7! Ways

Total ways = $16 \times 10 \times 7! = 20 \times 8!$

Hence, option B is correct.

Q119 Three chairs are arranged in a row facing three other chairs. 4 boys and 2 girls are to be seated on these chairs such that girls are always facing each other. In how many ways can they be seated? Ans.

There are three sets of chairs facing each other, we select one set, ways = 3

Now the girls can be seated on these two in 2! Ways

4 boys can be seated on the remaining four chairs in 4! Ways

Total ways = $3 \times 2 \times 4! = 144$

Hence, option C is correct.

Q120 In how many ways the letters of the word "UNDERDOG" can be arranged such that the first and last letters are same and no two vowels are together? Ans.

I. U, N, R, O, G, E and D (2 times)

For first and last letter to be same

First and last letter should be D

D __ __ __ __ __ __ D

__ N __ R __ G __

Now in the middle six letters no two vowels should be together

So first we arrange three consonants, ways = 3!

Now from the four available spaces we select three places and then arrange the three vowels there.

Ways = ${}^4C_3 \times 3!$

Total ways = $3! \times {}^4C_3 \times 3! = 144$

Hence, option D is correct.