Unit -I - SET THEORY

1. A collection of all well defined objects is called
   (a) set (b) group (c) coset (d) lattice **Ans: a**
2. Power set of empty set has exactly _________ subset.
   (a) one (b) two (c) zero(d) three **Ans: a**
3. What is the Cartesian product of A = {1, 2} and B = {a, b}?
   a) {(1, a), (1, b), (2, a), (b, b)}
   b) {(1, 1), (2, 2), (a, a), (b, b)}
   c) {(1, a), (2, a), (1, b), (2, b)}
   d) {(1, 1), (a, a), (2, a), (1, b)} **Ans: c**
4. What is the cardinality of the set of odd positive integers less than 10?
   (a) 10 (b) 5 (c) 3 (d) 20 **Ans: b**

5. 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**

6. What is the Cardinality of the Power set of the set {0, 1, 2}?
   (a) 8 (b) 6 (c) 7 (d) 9 **Ans: a**

7. 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?
   a) 19 b) 41 c) 21 d) 57 **Ans : b**

8. Let R be a non-empty relation on a collection of sets defined by ARB if and only if $A \cap B = \emptyset$ Then (pick the TRUE statement)
   a). R is reflexive and transitive b). R is an equivalence relation
   c). R is symmetric and not transitive d). R is not relexive and not symmetric **Ans: c**

9. The binary relation $S = \Phi$ (empty set) on set A = {1, 2,3} is
   a). transitive and relexive b). symmetric and relexive
   c). transitive and symmetric d). neither reflexive nor symmetric **Ans: c**

10. Number of subsets of a set of order three is
    a) 2 b) 4 c) 6 d) 8 **Ans: d**

11. "n/m" means that n is a factor of m, then the relation T is
    a). relexive, transitive and not symmetric b). relexive, transitive and symmetric
    c). transitive and symmetric d). relexive and symmetric **Ans: a**

12. Two sets are called disjoint if there _____________ is the empty set.

a) Union b) Difference c) Intersection d) Complement **Ans: c**

13. The set difference of the set A with null set is __________

a) A b) null c) U d) B **Ans: a**

14. An equivalence relation R on a set A is said to posses

(a) reflexive, antisymmetric and transitive (b) reflexive, symmetric and transitive

(c) reflexive, nonsymmetric and antisymmetric (d) irreflexive, symmetric and transitive **Ans: b**

15.Relative complement of S with respect to R is defined as

$(a)\ \{x / x \in R \text{ and } x \notin S\}$ $(b)\ \{x / x \in R \text{ and } x \in S\}$

$(c)\ \{x / x \notin R \text{ and } x \in S\}$ $(d)\ \{x / x \notin R \text{ and } x \notin S\}$ **Ans: a**

16. If the relation R is reflexive, antisymmetric and transitive, then the relation R is called

(a) equivalence relation (b) equivalence class (c) partial order relation

(d) partially ordered set **Ans: c**

17. A digraph representing the partial order relation

(a) Helmut Hasse (b) POSET (c) graph relation (d) Hasse diagram **Ans: d**

18. In a poset, the maximum number of greatest and least members if they exist are

(a) more than one (b) unique (c) zero (d) exactly two **Ans: b**

19. Equivalence class of 'a' is defined by

$(a)\ \{x / (a,x) \in R\}$ $(b)\ \{x / (x,a) \in R\}$ $(c)\ \{a / (a,x) \in R\}$ $(d)\ \{a / (x,a) \in R\}$ **Ans: a**

20. If A is a non-empty set with n elements, then number of possible relations on the set A is

(a) 2^n (b) 2^{n-1} (c) 2^{n^2} (d) 2^{n+1} **Ans: c**

21. Which one of the following relations on the set {1, 2, 3, 4} is an equivalent relation

(a) {(2,4), (4,2)} (b) {(2,2), (2,3), (2,4), (3,2), (3,3), (3,4)}

(c) {(1,3), (1,4), (2,3), (2,4), (3,1), (3,4)}(d) {(1,1), (1,2), (2,1), (2,2), (3,3), (4,4)} **Ans: d**

22. From each of the following relations, determine which is one of the relation is a partial order relation

(a) $R \subseteq Z \times Z$ where aRb if a divides b (b) R is the relation on Z, where aRb if a + b is odd

(c) $R \subseteq Z^+ \times Z^+$, where aRb if a divides b (d) none of these. **Ans: c**

23. Determine which one of the following relations on the set {1, 2, 3, 4} is a function.

(a) $R_1 = \{(1,1),(2,1),(3,1),(4,1),(3,3)\}$ (b) $R_2 = \{(1,2),(2,3),(4,2)\}$

(c) $R_3 = \{(4,4),(3,1),(1,2),(4,2)\}$ (d) $R_4 = \{(1,1),(2,1),(1,2),(3,4)\}$ **Ans: a**

24. How many possible functions we get $f : A \to B$, if $|A| = m$ and $|B| = n$

(a) 2^n (b) 2^m (c) n^m (d) m^n **Ans: c**

25. If $A = \{1,2,3\}$ and f, g are functions from A to A given by f = {(1,2), (2,3), (3,1)}, g = {(1,2), (2,1), (3,3)} then {(1,3), (2,2), (3,1)} is the composition relation of one of the following:

$(a)\ f \circ g$ $(b)\ g \circ f$ $(c)\ f \circ (f \circ g)$ $(d)\ f \circ (g \circ f)$ **Ans: a**

26. If $f(x)=ax+b, g(x)=1-x+x^2$ for $x \in R$, and $(g \circ f)(x)=9x^2-9x+3$. Find the values of a and b.

(a) a = 3, b = -1 (or) a = -3, b = 2 (b) a = 1, b = 3 (or) a = 1, b = 2

(c) a = -3, b = -1 (or) a = -3, b = 2 (d) a = 3, b = 2 (or) a = -3, b = -1 **Ans: a**

27. If $A=\{1,2,3,4\}, B=\{x,y,z\}$ and $f=\{(1,x),(2,y),(3,z),(4,x)\}$, then the function f is

(a) both 1 – 1 and onto (b) 1 – 1 but not onto

(c) onto but not 1 – 1 (d) neither 1 – 1 nor onto **Ans: c**

28. A Relation R is defined on the set of integers as xRy iff (x+y) is even . Which of the following statements is TRUE?

(a) R is not an equivalence relation

(b) R is an equivalence relation having one equivalence class

(c) R is an equivalence relation having two equivalence class

(d)R is an equivalence relation having three equivalence class **Ans: c**

29.The number of equivalence relations of the set {1,2,3,4} is

(a) 4 (c) 16

(b)15 (d) 24 **Ans: b**

30.If R be a symmetric and transitive relation on a set A, then

(a) R is reflexive and hence an equivalence relation

(b) R is reflexive and hence a parital order

(c) R is not reflexive and hence not an equivalence relation

(d)R is Reflexive **Ans: d**

31. Relation R defined on a set N by R={(a,b) : |a - b| is divisible by 5}, is

(a) reflexive (c) transitive

(b)symmetric (d) Equivalence **Ans: d**

32. The domain and range are same for

(a) constant function (c) absolute value function

(b)identity function (d) greatest integer function **Ans: b**

33. The function f : N →N given by f(x)=x^2 is

(a) one-one (c) one-one and onto

(b) onto (d) in-to **Ans: a**

34. A relation over the set S=[x,y,z]is defined by : {(x,x),(x,y),(y,x),(x,z),(y,z),(y,y),(z,z)}.

(a) Symmetric (c) Irreflexive

(b) Reflexive (d) Anti-symmetric **Ans: b**

35. If sets A and B have 3 and 6 elements each, then minimum number of elements in A ∪ B is

(a) 3 (c) 18

(b)6 (d) 9 **Ans: b**

36. f : R → R is a function defined by f (x) = 10x -7. If g = f^{-1},then g(x)

(a) $\frac{1}{10x-7}$ (c) $\frac{x+7}{10}$

(b) $\frac{1}{10x+7}$ (d) $\frac{x-7}{10}$ **Ans: c**

37.The set of all Equivalence classes of a set A of cardinality C

(a) has the same cardinality as A
(b) forms a partition of A
(c) is of cardinality 2C
(d) is of cardinality C^2 **Ans: b**

38.Which of the following sets is a null set

i. X={x| x=9, 2x =4} ii Y={x|x=2x.x≠0} iii Z={x|x-8=4}

(a) I and II only (c) I and III only
(b) I,II and III (d) I and III only **Ans: a**

39.Let A={1,2,3........} Define ~ by x ~ y ⇔ x divide y. Then ~ is

(a) reflexive, but not a parital-ordering
(b) symmetric
(c) an equivalence relation
(d) a parital- ordering relation **Ans: d**

40.If A={1,2,3}, then relation S={(1,1),(2,2) is

(a) symmetric only
(b) anti-symmetric only
(c) both symmetric and anti-symmetric only **Ans: c**
(d) an equivalence relation

41.If A={1,2,3,4}. Let ~ = {(1,2),(1,3),(4,2). Then ~ is

(a) not anti-symmetric (c) reflexive
(b) transitive (d) symmetric **Ans: b**

42.Let D_{30}={1,2,3,5,6,10,15,30} and relation I be a parital ordering on D_{30}.The all upper bounds of 10 and 15

respectively is

(a) 30 (b) 15 (c) 10 (d) 6 **Ans : a**

43.Let D_{30}={1,2,3,5,6,10,15,30} and relation I be a parital ordering on D_{30}.The lub of 10 and 15 respectively is

(a) 30 (c) 10
(b) 15 (d) 6 **Ans : a**

44.Total number of different partitions of a set having four elements

a). 16 b) 8 (c) 15 d) 4 **Ans : c**

45.Hasse diagrams are drawn for

(a) Partially ordered sets (c) boolean algebra
(b) Lattics (d) Modern Algebra **Ans: a**

46.Let X={2,3,6,12,24},and ≤ be the partial order defined on the set S={x,a_1,a_2,a_3,............,a_n,y} as ≤ a_i for i and a_i ≤ y for all i,where n ≥ 1. Number of total orders on the set S which contain partial order ≤ 1

(a) 1 (c) n+1
(b) n (d) n! **Ans: d**

47..Let X={2,3,6,12,24}, and $\leq$ be the parital order defined by $X \leq Y$ if X divides Y. Number of edges in the

Hasee diagram of (X, $\leq$) is

(a) 3 (c) 5

(b) 4 (d) 6 **Ans: b**

UNIT-2 Combinatorics and Number theory

1). In how many ways can 8 Indians,4 Americans and 4 English mens can be seated in a row so all person of the same nationality sit together?

a) 3! 4!8!4! b) 3! 8! c) 3! 4! D) 3! 3! 8! **Answer: a**

Solution:

Taking all person of same nationality as one person, then we will have only three people.

These three person can be arranged themselves in 3! Ways.

8 Indians can be arranged themselves in 8! Way.

4 American can be arranged themselves in 4! Ways.

4 Englishman can be arranged themselves in 4! Ways.

Hence, required number of ways = 3! 8! 4! 4! Ways.

2). How many permutations of the letters of the word APPLE are there?

a) 600 b) 120 c) 240 d) 60 **Answer: d**

Solution:

APPLE = 5 letters.

But two letters PP is of same kind.

Thus, required permutations,

=5!2!=1202=60

3). How many different words can be formed using all the letters of the word ALLAHABAD?

i). when vowels occupy the even positions ii) both L do not occur together.

a) 7560 , 60 , 4200 b) 7890 , 120 , 650 c) 7660 , 200 , 4444 d) 7670 , 240 , 444 **Answer: a**

Solution:

ALLAHABAD = 9 letters. Out of these 9 letters there is 4 A's and 2 L's are there.

So, permutations = 9!4!.2!9!4!.2! = 7560

(a) There are 4 vowels and all are alike i.e. 4A's.

_2nd _4th _6th _8th _

These even places can be occupied by 4 vowels. In

4!4!4!4!

= 1 Way.

In other five places 5 other letter can be occupied of which two are alike i.e. 2L's.

Number of ways = 5!2!5!2! Ways.

Hence, total number of ways in which vowels occupy the even places = 5!2!5!2! $\times$ 1 = 60 ways.

(b) Taking both L's together and treating them as one letter we have 8 letters out of which A repeats 4 times and others are distinct. These 8 letters can be arranged in 8!4!8!4! = 1680 ways.

Also two L can be arranged themselves in 2! ways.

So, Total no. of ways in which L are together = 1680 $\times$ 2 = 3360 ways.

Now, Total arrangement in which L never occur together,

= Total arrangement - Total no. of ways in which L occur together.

= 7560 – 3360 = 4200 ways

4). In how many ways can 10 examination papers be arranged so that the best and worst papers never come together?

a) 8 x 9! b) 8 x 8! c) 7 x 9! d) 9 x 8! **Answer: a**

Solution:

No. of ways in which 10 paper can arranged is 10! Ways.

When the best and the worst papers come together, regarding the two as one paper, we have only 9 papers.

These 9 papers can be arranged in 9! Ways.

And two papers can be arranged themselves in 2! Ways.

No. of arrangement when best and worst paper do not come together,

$= 10! - 9! \times 2! = 9!(10 - 2) = 8 \times 9!$

5). In how many ways 4 boys and 3 girls can be seated in a row so that they are alternate.

a) 144 b) 288 c) 12 d) 256 **Answer: a**

Solution:

Let the Arrangement be, **B G B G B G B**

4 boys can be seated in 4! Ways

Girl can be seated in 3! Ways

Required number of ways, $= 4! \times 3! = 144$

6). In how many ways 2 students can be chosen from the class of 20 students?

a) 190 b) 180 c) 240 d) 390 **Answer: a**

Solution:

Number of ways $= 20C_2$ =20!2!×18!=20×192=190

7) Three gentle men and three ladies are candidates for two vacancies .A voter has to vote for two Candidates .In how many ways one cast his vote?

a) 9 b) 30 c) 36 d) 16 **Answer: d**

Solution:

There are 6 candidates and a voter has to vote for any two of them.

So, the required number of ways is, $= 6C_2 = 6! / 2! \times 4! = 15$

8). A question paper has two A and B each containing 10 questions , if a student has to choose 8 from part A and 5 from part B .In how many ways can he chooses questions?

a) 11340 b) 12750 c) 40 d) 320 **Answer: a**

Solution:

There 10 questions in part A out of which 8 question can be chosen as = 10C8

Similarly, 5 questions can be chosen from 10 questions of Part B as = 10C5

Hence, total number of ways,

$=10C_8 \times 10C_5 = 11340$

9). The number of triangles which can be formed by joining the angular points of a polygon of 8 sides as vertices.

a) 56 b) 24 c) 16 d) 8 **Answer: a**

Solution:

A triangle needs 3 points.

And polygon of 8 sides has 8 angular points.

Hence, number of triangle formed,

$= 8C_3 = 56$

10). A drawer contains 12 red and 12 blue socks, all unmatched. A person takes socks out at random in the dark. How many socks must he take out to be sure that he has at least two blue socks?

a) 18 b) 35 c) 28 d) 14 **Answer: d**

Explanation: Given 12 red and 12 blue socks so, in order to take out at least 2 blue socks, first we need to take out 12 shocks (which might end up red in worst case) and then take out 2 socks (which would be definitely blue). Thus we need to take out total 14 socks.

11). The least number of computers required to connect 10 computers to 5 routers to guarantee 5 computers can directly access 5 routers is ______

a) 74 b) 104 c) 30 d) 67 **Answer: c**

Explanation: Since each 5 computer need directly connected with each router. So 25 connections + now remaining 5 computer, each connected to 5 different routers, so 5 connections = 30 connections. Hence, c1->r1, r2, r3, r4, r5

c2->r1, r2, r3, r4, r5 . c3->r1, r2, r3, r4, r5 . c4->r1, r2, r3, r4, r5 . c5->r1, r2, r3, r4, r5

c6->r1 . c7->r2 . c8->r3 . c9->r4 . c10->r5

Now, any pick of 5 computers will have a direct connection to all the 5 routers.

12). In a group of 267 people how many friends are there who have an identical number of friends in that group?

a) 266 b) 2 c) 138 d) 202 **Answer: b**

Explanation: Suppose each of the 267 members of the group has at least 1 friend. In this case, each of the 267 members of the group will have 1 to 267-1=266 friends. Now, consider the numbers from 1 to n-1 as holes and the n members as pigeons. Since there is n-1 holes and n pigeons there must exist a hole which must contain more than one pigeon. That means there must exist a number from 1 to n-1 which would contain more than 1 member. So, in a group of n members there must exist at least two persons having equal number of friends. A similar case occurs when there exist a person having no friends.

13). When four coins are tossed simultaneously, in _______ number of the outcomes at most two of the coins will turn up as heads.

a) 17 b) 28 c) 11 d) 43 **Answer: c**

Explanation: The question requires you to find number of the outcomes in which at most 2 coins turn up as heads i.e., 0 coins turn heads or 1 coin turns head or 2 coins turn heads. The number of outcomes in which 0 coins turn heads is ${}^4C_0 = 1$ outcome. The number of outcomes in which 1 coin turns head is ${}^4C_1 = 6$ outcomes. The number of outcomes in which 2 coins turn heads is,

${}^4C_2 = 15$ outcomes. Therefore, total number of outcomes = 1 + 4 + 6 = 11 outcomes.

14). How many numbers must be selected from the set {1, 2, 3, 4} to guarantee that at least one pair of these numbers add up to 7?

a) 14 b) 5 c) 9 d) 24 **Answer: b**

Explanation: With 2 elements pairs which give sum as 7 = {(1,6), (2,5), (3,4), (4,3)}. So choosing 1 element from each group = 4 elements (in worst case 4 elements will be either {1,2,3,4} or {6,5,4,3}). Now using pigeonhole principle = we need to choose 1 more element so that sum will definitely be 7. So Number of elements must be 4 + 1 = 5.

15). During a month with 30 days, a cricket team plays at least one game a day, but no more than 45 games. There must be a period of some number of consecutive days during which the team must play exactly ______ number of games.

a) 17 b) 46 c) 124 d) 24 **Answer: d**

Explanation: Let a1 be the number of games played until day 1, and so on, ai be the no games played until i. Consider a sequence like a1,a2,…a30 where 1≤ai≤45, ∀ai. Add 14 to each element of the sequence we get a new sequence a1+14, a2+14, … a30+14 where, 15 ≤ ai+14 ≤ 59, ∀ai. Now we have two sequences 1. a1, a2, …, a30 and 2. a1+14, a2+14, …, a30+14. having 60 elements in total with each elements taking a value ≤ 59. So according to pigeon hole principle, there must be at least two elements taking the same value ≤59 i.e., ai = aj + 14 for some i and j. Therefore, there exists at least a period such as aj to ai, in which 14 matches are played.

16). There are 10 points in a plane and 4 of them are collinear. The number of straight lines joining any two points is

(a) 45 (b) 40 (c) 39 (d) 38. **Ans :** b

17). Number of sides of a polygon having 44 diagonals is (a) 4 (b) 4! (c) 11 (d) 22 **Ans :** c

18). In a plane there are 10 points are there out of which 4 points are collinear, then the number of triangles formed is

(a) 110 (b) $_{10}C_3$ (c) 120 (d) 116 **Ans d**

18). In an examination there are three multiple choice questions and each question has 5 choices . Number of ways in which a student can fail to get all answer correct is

(a) 125 (b) 124 (c) 64 (d) 63 **Ans : b**

19) Assuming that repetitions are not permitted, how many four-digit numbers are less than 4000 , can be formed form the six digits 1, 2, 3, 5, 7, 8?

(a) 125 (b) 124 (c) 180 (d) 63 **Ans : c**

Explanation:

If a 4-digit number is to be less than 4000, the first digit must be 1, 2, or 3. Hence the first space can be filled up in 3 ways. Corresponding to any one of these 3 ways, the remaining 3 spaces can be filled up with the remaining 5 digits in P(5, 3) ways. Hence, the required number = 3 x P(5, 3)
= 3 x 5 x 4 x 3 = 180.

20). How many bit strings of length 10 contain (a) exactly four 1's,

(a) 200 (b) 210 (c) 220 (d) 230 **Ans : b**

Explanation:

A bit string of length 10 can be considered to have 10 positions. These 10 positions should be filled with four 1's and six 0's No. of required bit strings = $\frac{10!}{4!\,6!} = 210$

21) If we select 10 points in the interior of an equilateral triangle of side 1, then there must be at least two points whose distance apart is

a) $= \frac{1}{3}$ b) $< \frac{1}{3}$ c) $> \frac{1}{3}$ d) $\geq \frac{1}{3}$ **Ans : b**

22) In any group of six people, how many of at least ------- must be mutual friends or at least -------- must be Mutual strangers.

(a) 2 (b) 4 (c) 3 (d) 5 **Ans : c**

23) The Pascal's identity in the theory of combination is

a) $nC_{r-1} + nC_r = (n+1)C_r$ b) $nC_{r+1} + nC_r = (n+1)C_r$

b) c) $nC_{r-1} + nC_{r+1} = (n+1)C_r$ d) $nC_{r-1} + nC_r = (n+1)C_{r+1}$ **Ans : a**

24) The number of arrangements of all the six letters in the word **PEPPER** is

(a) 70 (b) 80 (c) 60 (d) 50 **Ans : c**

25) How many different outcomes are possible when 5 dice are rolled ?

(a) 452 (b) 152 (c) 352 (d) 252 **Ans : d**

26) In a group of 100 people, several will have birth days in the same month.At least how many must have birth days in the same month?

(a) 6 (b) 9 (c) 19 (d) 29 **Ans : b**

27) If 20 processors are interconnected and every processor is connected to at least one other, Then at least how many processors are directly connected to the same number of processors ?

(a) 2 (b) 3 (c) 4 (d) 1 **Ans : a**

28) Among 30 Computer Science students, 15 know JAVA, 12 know C++ and 5 know both. How many students know exactly one of the languages.

(a) 27 (b) 22 (c) 17 (d) 5 **Ans : c**

29). How many positive integers not exceeding 1000 are divisible by 7 or 11?

(a) 270 (b) 22 0 (c) 170 (d) 50 **Ans : b**

30) If there are 5 points inside a square of side length 2, prove that two of the points are within a distance of ----------- of each other.

a) $\sqrt{2}$ b) $\sqrt{3}$ c) $\sqrt{5}$ d) $\sqrt{7}$ **Ans : a**

31) Greatest Common Divisor of two numbers is 8 while their Least Common Multiple is 144. Then the other

number if one number is 16.

(a) 108 (b) 96 (c) 72 (d) 36 **Ans : c**

32) LCM of two numbers is 138. But their GCD is 23. The numbers are in a ratio 1:6. Which is the largest number amongst the two?

(a) 46 (b) 138 (c) 69 (d) 23 **Ans : b**

33) The least common multiple of two numbers is 168 and highest common factor of them is 12. If the difference between the numbers is 60, what is the sum of the numbers?

(a) 108 (b) 96 (c) 122 (d) 144 **Ans : a**

34) If least common multiple of two numbers is 225 and the highest common factor is 5 then find the numbers

when one of the numbers is 25?

(a) 75 (b) 65 (c) 15 (d) 45 **Ans : d**

35) The greatest number of four digits which is divisible by 15, 25, 40, 75 is

(a) 600 (b) 9000 (c) 9600 (d) 9400 **Ans : c**

36) When a number is divided by 893 the remainder is 193. What will be the remainder when it is divided by

47?

(a) 19 (b) 5 (c) 33 (d) 23 **Ans : b**

Explanation:

In such cases and sums, simply follow these easy steps

Number is divided by 893. **Remainder = 193.**

Also, we observe that 893 is exactly divisible by 47.

So now simply divide the remainder by 47.

47	193	**4**
	-188	
	05	

So remainder is 5

37) The greatest length of the scale that can measure exactly 30 cm, 90 cm, 1 m 20 cm and 1 m 35 cm lengths
Is

(a) 5 cm (b) 10 cm (c) 15 cm (d) 30 cm **Ans : c**

38) A Least Common Multiple of a, b is defined as ___________

(a) It is the smallest integer divisible by both a and b

(b) It is the greatest integer divisible by both a and b

(c) It is the sum of the number a and b

(d) It is the difference of the number a and b **Ans : a**

39) If a, b are integers such that a > b then lcm(a, b) lies in __________

(a) a> lcm(a, b) > b (b) a > b >lcm(a, b) (c) lcm(a, b) ≥ a> b (d) b > lcm(a, b) < b **Ans : c**

40) The product of two numbers are 12 and their Greatest common divisor is 2 then LCM is?

(a) 12 (b) 2 (c) 6 (d) 16 **Ans : c**

41) If LCM of two number is 14 and GCD is 1 then the product of two numbers is?

(a) 14 (b) 15 (c) 7 (d) 49 **Ans : a**

42) If 'a' is $2^2 \times 3^1 \times 5^0$ and 'b' is $2^1 \times 3^1 \times 5^1$ then lcm of a , b is

(a) $2^2 \times 3^1 \times 5^1$ (b) $2^2 \times 3^2 \times 5^2$ (c) $2^3 \times 3^1 \times 5^0$ (d) $2^2 \times 3^2 \times 5^0$ **Ans : a**

43) The lcm of two prime numbers a and b is

(a) a /b (b) ab (c) a+b (d) 1 **Ans : b**

44) The prime factorization of 7007 is ___________

(a) $7^3 \times 11 \times 13$ (b) $7^2 \times 11 \times 13$ (c) $7 \times 11 \times 13$ (d) $7 \times 11^3 \times 13$ **Ans : b**

45) Which positive integer less than 21 are relatively prime to 21?

(a) 18 (b) 19 (c) 21 (d) 24 **Ans : b**

46) The greatest common divisor of $3^{13}, 5^{17}$ and $2^{12}, 3^5$ is ___________

(a) 3^0 (b) 3^1 (c) 3^3 (d) 3^5 **Ans : d**

47) The greatest common divisor of 0 and 5 is ____________

(a) 0 (b) 1 (c) 2 (d) 5 **Ans : b**

Explanation: $gcd(0, 5) = 0^{min(1, 0)}.5^{min(0, 1)}$.

48) The lcm of 3 and 21 is _________ if gcd(3,21)=3.

(a) 3 (b) 12 (c) 21 (d) 42 **Ans : c**

49) The linear combination of gcd(252, 198) = 18 is?

(a) 252*4 – 198*5 (b) 252*5 – 198*4 (c) 252*5 – 198*2 (d) 252*4 – 198*4 **Ans : a**

50) The linear combination of gcd(117, 213) = 3 can be written as _________
(a) 11*213 + (-20)*117 (b) 10*213 + (-20)*117 (c) 11*117 + (-20)*213 (d) 20*213 + (-25)*117 **Ans : a**

Unit-3 Mathematical logic

1.Which of the following statement is the negation of the statement " 2 is even and -3 is negative"?

a)2 is even and -3 is not negative b)2 is odd and -3 is not negative

c)2 is not odd and -3 is not negative d)2 is odd or -3 is not negative **Ans (d)**

2.The contra positive of $q \to p$ is a)$p \to q$ b)$\neg p \to \neg q$ c) $\neg q \to \neg p$ d)$p \to \neg q$ **Ans (b)**

3.What is the converse of the assertion I stay only if you go?

a) I stay if you go b)if you don't go then I don't stay

c)if I stay then you go d)if you don't stay then you go **Ans (a)**

4.$P \vee T \Leftrightarrow T$ is called a)identity law b)complement law c)dominant law d)idempotent law **Ans (c)**

5.The statement $P \vee \neg P$ is a a)contradiction b)tautology c)contrapositive d)inverse **Ans (b)**

6) Dual of $\neg (p \leftrightarrow Q) = (P \wedge \neg Q) \vee (\neg P \wedge Q)$

a) $\neg (P \leftrightarrow Q) \equiv (P \vee \neg Q) \vee (\neg P \vee Q)$ b) $(P \leftrightarrow Q) \equiv (\neg P \vee Q) \vee (P \vee \neg Q)$

c) $\neg (P \leftrightarrow Q) \equiv (P \vee \neg Q) \wedge (\neg P \vee Q)$ d) $\neg (P \leftrightarrow Q) \equiv (\neg P \vee Q) \wedge (P \vee \neg Q)$ **Ans (c)**

7.The rule if a formula S can be derived from another formula R and A set of premises,then the statement

$R \to S$ can be derive from the set of premises is called

a)Rule CP b)Rule T c)Rule P d)Rule US
Ans (a)

8.The statement $(P \vee Q) \wedge (P \to R) \wedge (Q \to R)$implies a)R b)P c)Q d)$P \wedge Q$ **Ans (a)**

9.The statement $\neg (P \leftrightarrow Q)$ is equivalent to a)$P \leftrightarrow \neg Q$ b) $\neg P \leftrightarrow \neg Q$ c)$P \to \neg Q$ d) $\neg P \to \neg Q$ **Ans (a)**

10. $\neg P \rightarrow Q =$ a)$QV\neg P$ b)$Q \wedge P$ c)PVQ d) $\neg P \wedge Q$ **Ans (c)**

11. $\neg P, PVQ \Rightarrow$ a) Q b) $\neg P$ c)PVQ d)$P \wedge Q$ **Ans (a)**

12.$((P \rightarrow Q)V(\neg PV(Q \rightarrow R))VT=$ a)$P \rightarrow Q$ b) $\neg P$ c)T d)F **Ans (c)**

13.A compound proposition $P=P(P_1,P_2,\ldots\ldots.P_n)$which is true for every truth values for $P_1,P_2,\ldots.,P_n$ is called

a)Contradiction b)Tautology c)Negation d)Implication **Ans (b)**

14) $(P \rightarrow \neg P) \rightarrow \neg P$ is equivalent to a)T b)F c)P d) $\neg P$ **Ans (c)**

15)The dual of $\neg P \rightarrow (P \rightarrow Q)$ is

a)$PV(\neg P \wedge Q)$ b) $\neg(\neg P) \wedge (\neg P \wedge Q)$ c)$P \rightarrow \neg(P \rightarrow Q)$ d)$(\neg P \wedge Q) \wedge \neg P$ **Ans (b)**

16.In proving that $P \rightarrow (Q \rightarrow S)$ follows from the premises $P \rightarrow (Q \rightarrow R)$ and $Q \rightarrow (R \rightarrow S)$ using CP rule, the additional premises is a)Q b)$Q \rightarrow R$ c)P d) $\neg P$
Ans (c)

17.Let P is sunny this afternoon ,Q is colder than yesterday and R is we will go for swimming. Then the statement if it is not sunny this afternoon and it is colder than yesterday, then we will go for swimming is

a)$(\neg P \wedge Q) \rightarrow R$ b)$(P \wedge \neg Q) \rightarrow \neg R$ c)$(\neg PVQ) \rightarrow R$ d)$(\neg P \wedge Q)VR$ **Ans (a)**

18.Which of the following statement is a contradiction?

a)$(P \rightarrow \neg P) \rightarrow \neg P$ b)$(P \rightarrow (P \vee Q)$ c)$(\neg Q \rightarrow P) \wedge Q$ d) $PV(P \rightarrow Q)$ **Ans (a)**

19.What is the dual of $(P \rightarrow Q) \rightarrow (\neg Q \rightarrow \neg P) \equiv T$,

a)$(\neg P \rightarrow Q) \wedge (Q \wedge \neg P) \equiv F$ b) $\neg(P \wedge Q) \wedge (Q \wedge P) \equiv T$

c)$(\neg P \wedge) \wedge (Q \wedge \neg P) \equiv F$ d) $\neg(\neg PVQ) \wedge (Q \wedge \neg P) \equiv F$ **Ans (d)**

20.$(PVQ) \wedge \neg(\neg P \wedge Q)$ is equivalent to a)P b)Q c)PVQ d)$P \wedge Q$ **Ans (a)**

21.Which one is the contra positive of $Q \to P$?

a)$P \to Q$ b) $\neg P \to \neg Q$ c) $\neg Q \to \neg P$ d) $\neg P V Q$ **Ans (b)**

22.The statement $(P \wedge Q) \Rightarrow P$ is a

a)contradiction b)tautology c)inconsistent d)consistent **Ans (d)**

23.The dual of $\neg (P \wedge Q) V T$ is

a)$(PVQ) \wedge F$ b)$(PVQ) \wedge T$ c)$(P \wedge Q) VF$ d) $\neg (PVQ) \wedge F$ **Ans (d)**

24.Which of the following is a statement?

(A) Open the door. (B) Do your homework. (C) Switch on the fan **(D)** Two plus two is four. **Ans (D)**

25.Which of the following is a statement in Logic?
(A) Go away (B) How beautiful! (C) $x > 5$ **(D)** $2 = 3$ **Ans (D)**

26. $\sim (p \vee q)$ is (A) $\sim p \vee q$ (B) $p \vee \sim q$ (C) $\sim p \vee \sim q$ **(D)** $\sim p \wedge \sim q$ **Ans (D)**

27.If p: The sun has set, q: The moon has raised, then symbolically the statement 'The sun has not set or the moon has not risen' is written as
(A) $p \wedge \sim q$ (B) $\sim q \vee p$ (C) $\sim p \wedge q$ **(D)** $\sim p \vee \sim q$ **Ans (D)**

28.The inverse of logical statement $p \to q$ is
(A) $\sim p \to \sim q$ (B) $p \leftrightarrow q$ (C) $q \to p$ (D) $q \leftrightarrow p$ **Ans (A)**

29.Let p: Mathematics is interesting, q: Mathematics is difficult, then the symbol $p \to q$ means
(A) Mathematics is interesting implies that Mathematics is difficult.
(B) Mathematics is interesting is implied by Mathematics is difficult.
(C) Mathematics is interesting and Mathematics is difficult.
(D) Mathematics is interesting or Mathematics is difficult. **Ans (A)**

30.Which of the following is logically equivalent to $\sim (p \wedge q)$
(A) $p \wedge q$ **(B)** $\sim p \vee \sim q$ (C) $\sim (p \vee q)$ (D) $\sim p \wedge \sim q$ **Ans (B)**

31.$\sim (p \to q)$ is equivalent to

(A)$p\wedge\sim q$ (B) $\sim p \vee q$ (C) $p \vee\sim q$ (D) $\sim p \wedge\sim q$ **Ans (A)**

32.Contrapositive of $p \rightarrow q$ is

(A) $q\rightarrow p$ (B) $\sim q \rightarrow p$ **(C)** $\sim q \rightarrow\sim p$ (D) $q \rightarrow\sim p$ **Ans (C)**

33.A compound statement $p \rightarrow q$ is false only when

(A) p is true and q is false. (B) p is false but q is true.

(C) atleast one of p or q is false. (D) both p and q are false. **Ans (A)**

34.Every conditional statement is equivalent to

(A) its contrapositive (B) its inverse (C) its converse (D)only itself **Ans (A)**

35Statement $\sim p \leftrightarrow\sim q \equiv p \leftrightarrow q$ is

(A)a tautology (B) a contradiction (C) contingency (D) proposition **Ans (A)**

36.Given that p is 'false' and q is 'true' then the statement which is 'false' is

(A) $\sim p \rightarrow\sim q$ (B) $p \rightarrow(q \wedge p)$ (C) $p \rightarrow\sim q$ (D) $q \rightarrow\sim p$ **Ans (A)**

37.Dual of the statement $(p \wedge q) \vee\sim q \equiv p \vee\sim q$ is

(A) $(p\vee q) \vee\sim q \equiv p \vee\sim q$ (B) $(p \wedge q) \wedge\sim q \equiv p \wedge\sim q$

(C) $(p\vee q) \wedge\sim q \equiv p \wedge\sim q$ (D) $(\sim p \vee\sim q) \wedge q \equiv\sim p \wedge q$ **Ans (C)**

38.$\sim[p \vee(\sim q)]$ is equal to

(A) $\sim p \vee q$ **(B)** $(\sim p) \wedge q$ (C) $\sim p \vee\sim p$ (D) $\sim p \wedge\sim q$ **Ans (B)**

39.Write Negation of 'For every natural number x, $x + 5 > 4$'.

(A) $\forall x \in N, x + 5 < 4$ (B) $\forall x \in N, x - 5 < 4$ (C) For every integer x, $x + 5 < 4$

(D) There exists a natural number x, forwhich $x + 5 \leq 4$ **Ans (D)**

40. If p is false and q is true, then

(A) $p\wedge q$ is true (B) $p \vee\sim q$ is true (C) $q \rightarrow p$ is true **(D)** $p \rightarrow q$ is true **Ans (D)**

41.If p and q have truth value 'F' then $(\sim p \vee q) \leftrightarrow\sim(p \wedge q)$ and $\sim p \leftrightarrow(p \rightarrow\sim q)$ respectively are

(A) T, T (B) F, F (C) T, F (D) F, T **Ans (A)**

42.Which of the following is logically equivalent to $\sim[p \rightarrow(p \vee\sim q)]$?

(A) $p\vee(\sim p \wedge q)$ **(B)** $p \wedge(\sim p \wedge q)$ (C) $p \wedge(p \vee\sim q)$ (D) $p \vee(p \wedge\sim q)$ **Ans (B)**

43.If $\sim q \vee p$ is F then which of the following is correct?

(A) $p\leftrightarrow q$ is T **(B)** $p \rightarrow q$ is T (C) $q \rightarrow p$ is T (D) $p \rightarrow q$ is F **Ans (B)**

44.Which of the following is true?

(A) $p \wedge\sim p \equiv T$ (B) $p \vee\sim p \equiv F$ (C) $p \rightarrow q \equiv q \rightarrow p$ **(D)** $p \rightarrow q \equiv(\sim q) \rightarrow(\sim p)$ **Ans (D)**

45.The statement $(p \wedge q) \rightarrow p$ is

(A) a contradiction. **(B)**a tautology .(C) either (A) or (B) (D) a contingency. **Ans (B)**

46.Negation of the statement: "If Dhonilooses the toss then the team wins", is

(A) Dhoni does not lose the toss and theteam does not win.

(B) Dhoni loses the toss but the team doesnot win.

(C) Either Dhoni loses the toss or the teamwins. (D) Dhoni loses the toss iff the team wins. **Ans (A)**

47.If $p \Rightarrow(\sim p \vee q)$ is false, the truth values of p and q respectively, are

(A) F, T (B) F, F (C) T, T **(D)** T, F **Ans (D)**

48.The logically equivalent statement of $p \leftrightarrow q$ is

(A) $(p\wedge q) \vee(q \rightarrow p)$ (B) $(p \wedge q) \rightarrow(p \vee q)$ **(C)** $(p \rightarrow q) \wedge(q \rightarrow p)$ (D) $(p \wedge q) \vee(p \wedge q)$ **Ans (C)**

49) By induction hypothesis, the series $1^2 + 2^2 + 3^2 + \ldots + p^2$ can be proved equivalent to ____________

a) $\frac{p^2 + 2^k}{7}$ b) $\frac{p(p+1)(2p+1)}{6}$ c) $\frac{p(p+1)}{4}$ d) $p + p^2$ **Ans: b**

50) For any positive integer m ______ is divisible by 4.

a) $5m^2 + 2$ b) $3m + 1$ c) m^2+3 d) $m^3 + 3m$ **Ans: d**

51) According to principle of mathematical induction, if $P(k+1) = m^{(k+1)} + 5$ is true then _____ must be true.

a) $P(k) = 3m^k$ b) $P(k) = m^k + 5$ c) $P(k) = m^{k+2} + 5$ d) $P(k) = m^k$ **Ans: b**

52) What is the induction hypothesis assumption for the inequality $m! > 2^m$ where m>=4?

a) $for\ m = k,\ (k+1)! > 2^k\ holds$ b) $for\ m = k,\ k! > 2^k\ holds$

c) $for\ m = k,\ k! > 3^k\ holds$ d) $for\ m = k,\ k! > 2^{k+1}\ holds$ **Ans: b**

53. For all $n \in N - \{1\}$, $7^{2n} - 48n - 1$ is divisible by …….

(a) 25 (b) 26 (c) 1234 **(d) 2304**

54. $\forall n \in N$, P(n): $2.7^n + 3.5^n - 5$ is divisible by …….

(a) 64 (b) 676 (c) 17 **(d) 24**

55. $\forall n \geq 2, n^2(n^4 - 1)$ is divisible by …….

(a) 60 (b) 50 (c) 40 (d) 70

56. For $n \in N,\ 10^{n-2} > 81n$, if….

(a) $n > 5$ **(b) $n \geq 5$** (c) $n < 5$ (d) $n > 6$

57. For each $n \in N$, the correct statement is …..

(a) $2^n < n$ (b) $n^2 > 2^n$ (c) $\boldsymbol{n^4 < 10^n}$ (d) $2^{3n} > 7n + 1$

58. If $a_n = 2^{2^n} + 1$, then for n>1, $n \in N$, last digit of a_n is…..

(a) 3 (b) 5 (c) 8 (d) 7

59. If $P(n): 4^n / (n+1) < (2n)! / (n!)^2$, then P(n) is true for ……

(a) $n \geq 1$ (b) $n > 0$ (c) $n < 0$ (d) $\boldsymbol{n \geq 2,\ n \in N}$

60. By principle of mathematical induction,
$\forall n \in N\ cos\ 9\ cos\ 2\theta\ cos\ 4\theta \cdots cos[(2^{n-1})\theta] =$ … …

(a) $\boldsymbol{sin\ 2^n\theta\ /\ 2^n\ sin\ \theta}$ (b) $cos\ 2^n\theta\ /\ 2^n\ sin\ \theta$

(c) $sin\ 2^n\theta\ /\ 2^{n-1}\ sin\ \theta$ (d) $\sin 2^{n-1}\theta \big/ 2^n \sin\theta$

61. By principle of mathematical induction, $\forall\ n \in N$,
$1/(1.2.3) + 1/(2.3.4) + \cdots + 1\ /\ \{n(n+1)(n+2)\} =$………

(a) n(n+1) /4(n+2)(n+3) **(b) n(n+3) /4(n+l)(n+2)**

(c) n{n+2) /4(n+1){n+3) (d) None of these

62. By principle of mathematical induction, $\forall\ n \in N,\ 5^{2n+1} + 3^{n+2}.2^{n-1}$ is divisible by…..

(a) 19 (b) 18 (c) 17 (d) 14

63. The product of three consecutive natural numbers is divisible by ……

(a) 6 (b) 5 (c) 7 (d) 4

64. $\forall\ n \in N, a^n - b^n$ is always divisible by….. (a and b are distinct rational nos)

(a) 2a-b (b) a+b **(c) a-b** (d) a-2b

65. If $x^{2n-1} + y^{2n-1}$ is divisible by x+y, then n is…

(a) Positive integer (b) only for an even positive integer

(c) an odd positive integer (d) $\forall\ n \in N, n \geq 2$

66. The inequality $n! > 2^{n-1}$ is true for…..

(a) $\boldsymbol{n > 2,\ n \in N}$ (b) $n < 2$ (c) $\forall\ n \in N$ (d) n < 1

67. The smallest positive integer n for which $n! < \left\{\frac{n+1}{2}\right\}^n$ holds, is ….

(a) 1 **(b) 2** (c) 3 (d) 4

68. The greatest positive integer, which divides (n+2)(n+3) (n+4)(n+5)(n+6) $\forall\ n \in N$ is….

(a) 120 (b) 4 (c) 240 (d) 24

69. $x(x^{n-1} - n\alpha^{n-1}) + \alpha^n (n-1)$ is divisible by $(x-\alpha)^2$ for…..

(a) $n > 1$ (b) $n > 2$ **(c)** $\forall \boldsymbol{n} \in \boldsymbol{N}$ (d) n < 2

70. For each $n \in N$, $3^{2n} - 1$ is divisible by ……

(a) **8** (b) 16 (c) 32 (d) 18

71. For each $n \in N$, $2^{3n} - 7n - 1$ is divisible by ……

(a) 64 (b) 36 **(c) 49** (d) 25

72. For each $n \in N$, $10^{2n-1} + 1$ is divisible by ……

(a) **11** (b) 13 (c) 9 (d) 15

73. For each $n \in N, 2\left(4^{2n+1} + 3^{n+1}\right)$ is divisible by ……

(a) 2 (b) 9 (c) 3 (d) 11

74. Let $P(n): n^2 + n + 1$ is and odd integer. If it is assumed that P(k) is true => P(k+1) is true. Therefore, P(n) is true…

(a) for n>1 **(b)** $\forall\ n \in N$

(c) for n>2 (d) for n > 3

75. Let $P(n): 3^n < n!, n \in N$, then P(n) is true…

(a) for $n \geq 6$ **(b)** $\boldsymbol{for\ n \geq 7, n \in N}$

(c) for $n \geq 3$ (d) $\forall\ n$

76. Let $P(n): 1 + 3 + 5 + \cdots + (2n-1) = n^2$, is…

(a) true for n>1 **(b)** $\boldsymbol{true\ \forall\ n \in N}$

(c) true for no n (d) true for n< 1

77. If $\forall\ \boldsymbol{n} \in \boldsymbol{N}$, P(n) is a statement such that, if P(k) is true => P(k+1) is true for $\boldsymbol{k} \in \boldsymbol{N}$, then P(n) is true…

(a) $\forall\ n > 1$ **(b)** $\forall\ n \in N$

(c) $\forall\ n > 2$ (d) $\forall n < 2$

78. Let $P(n): 1 + 3 + 5 + \cdots + (2^n - 1) = 3 + n^2$, then which of the following is true?

(a) P(1) is true **(b) P(k) is true=> P(k+1) is true**

(c) P(k) is true, P(k+1) is not true (d) P (2) is true

79. If matrix $A = \begin{bmatrix}1 & 0\\1 & 1\end{bmatrix}$ $and\ I = \begin{bmatrix}1 & 0\\0 & 1\end{bmatrix}$, then which one of the following holds $\forall\ n \in N$, (use PMI)

(a) $A^n = n.A - (n-1)I$ (b) $A^n = 2^{n-1}.A + (n-1)I$

(c) $A^n = n.A + (n-1)I$ (d) $A^n = 2^{n-1}.A - (n-1)I$

80. $S_n = 2.7^n + 3.5^n - 5$, $n \in N$ is divisible by the multiple of……

(a) 5 (b) 7 **(c) 24** (d) 25

81. $10^n + 3(4^{n+2}) + 5$, $n \in N$ is divisible by……

(a) 7 (b) 5 **(c) 9** (d) 17

82. $\forall\ \boldsymbol{n} \in \boldsymbol{N}, \left(3 + 5^{\frac{1}{2}}\right)^n + \left(3 - 5^{\frac{1}{2}}\right)^n$ is…

(a) Even natural number (b) Odd natural number

(c) Any natural number (d) Rational number

83. The remainder, when 5^{99} is divided by 13, is ……

(a) 6 **(b) 8** (c) 9 (d) 10

84. For all positive integral values of n, $n^{3n} - 2n + 1$ is divisible by ……

(a) 2 (b) 4 (c) 8 (d) 12

85. If $n \in N, then\ 11^{n+2} + 12^{2^n+1}$ is divisible by ……

(a) 113 (b) 123 **(c) 133** (d) 143

86. If $n \in N, P(n)\colon 2^n(n-1)! < n^n$ is true, if ……

(a) n<2 **(b) n>2** (c) $n \geq 2$ (d) n > 3

Unit-4 Algebraic Structure(Group,Ring & Field)

1. $*: A \times A \rightarrow A$ is said to be a binary operation if

a) $a*b \in A\ \ forsome\ a \in A$ b) $a*b \in A\ \ forsome\ b \in A$

c). $a*b \in A\ \ forsome\ a,b \in A$ d) $a*b \in A\ \ forall\ a,b \in A$ **Ans : d**

2. _______ is not a binary operation on the set of natural numbers.

a) + b) - c) x d) $+_n$ **Ans: b**

3. ______ is not a binary operation on the set of natural numbers.

   a) + b) - c) x d) ÷ **Ans d**

4. If $a*(b*c)=(a*b)*c \ ,\forall a,b,c \in S$ then * is said to be ---------- in S.

   a) Closed b) Commutative c) Associative d) Distributive **Ans c**

5. (S,*) is said to be a semi group if

   a) * is Closed b) * is Associative c) * is both closed and Associative d) it has identity element

   Ans: c

6. The semi-group (S,*) is said to be a monoid if S has

   a) Identity b) inverse c) satisfies commutative law d) satisfies distributive law **Ans a**

7. Let * be a binary operation on S defined by a*b = a+b+2ab then the identity element w.r.to * is

   a) 0 b) 1 c) 2 d) 3 **Ans a**

8. Let $G = Q^{+} and \ \ a*b=\frac{ab}{2}, \forall a,b \in Q^{+}$ .Then inverse of 'a' is

   a) $\frac{1}{a}$ b) $\frac{2}{a}$ c) $\frac{3}{a}$ d) $\frac{4}{a}$ **Ans : d**

9. The set of all real numbers under the usual multiplication operation is not a group since

   a) Multiplication is not a binary operation b) Multiplication is not associative

   c) Identity elements does not exist d) Zero has no inverse **Ans : d**

10. $G=(Z_5, \times_5)$ is --------

    a) Semigroup b) Monoid c) Group d) Abelian group **Ans: b**

11. The identity element In the group G = {2, 4, 6, 8) under multiplication modulo 10 is

    a) 5 b) 9 c) 6 d) 12 **Ans : c**

12. If (G, .) is a group such that $(ab)^{-1} = a^{-1} b^{-1}$, $\forall$ a,b$\in$G. Then G is a

    a. Commutative semi c. Non-abelian group

    b. Abelian group d. None of the above **Ans: b**

13. If (G,.) is a group such that $a^2 = e$, $\forall$ a $\in$ G, then G is

    a. semi group c. non-abelian group

    b. abelian group d. none of above **Ans: b**

14. The inverse of – i in the multiplication group {1,-1,i,-i} is

    a. 1 c. i

    b. -1 d. –I **Ans: c**

15. In the group (G,.), the value of $(a^{-1} b)^{-1}$ is

    a. ab^{-1} c. $a^{-1}b$

    b. $b^{-1}a$ d. ba^{-1} **Ans: b**

16. If (G,.) is a group, such that $(ab)^2 = a^2 b^2$, $\forall$ a,b$\in$G then G is an

    a. Commutative semi group c. Non-abelian group

b. abelian group d. None of these **Ans: b**

17. The identity element of a group (G,*) is
   a. Unique c. Infinite
   b. Uncountable d. None of these **Ans: a**
18. If G = {1,-1,i,-i}, then (G,×) is a cyclic group with the generator
   a. i and –I b. i and 1
   c.1 and -1 d. –i and 1 **Ans: a**
19. .Every group of prime order is
   a.) Cyclic and hence abelian b) Abelian and hence cyclic
   b.) c) Not cyclic and abelian d) Not abelian and cyclic **Ans : a**
20. What are the generators of the group (Z,+) ?
   a.) 1 and 0 b) -1 and 0 c) 0 alone d) 1 and -1 **Ans : d**

21. The necessary and sufficient condition that a non-empty subset of H of a group G to be a sub-group is

a) a, b $\in$ H => $a^{-1}, b^{-1} \in$ H b) a, b $\in$ H => $a*b^{-1} \in$ H

c) a, b$\in$ H => a*b $\in$ H d) a, b $\in$ H => $(a*b)^{-1} \in$ H **Ans : b**

22.Let G be a group. If a, b € G then inverse of (a*b) is

a) $a^{-1}*b^{-1}$ b) $a*b^{-1}$ c) $a^{-1}*b$ d) $b^{-1}*a^{-1}$ **Ans : d**

23. Which one of subsets of a group G = {1, -1, i, i} is a sub-group of G under multiplication?

a.) {i, -i} b) {i, i} c) {1, -i} d) {1, -1} **Ans : d**

24.Order of a sub-group of a finite group divides the order of the group is called

a.) Lagrange's Theorem b) Group homomorphism

c) Cayley's Theorem d) Fundamental Theorem of homomorphism **Ans : c**

25. A function f : (X, .) -> (Y,*) is said to be homomorphism **Ans : a**

a.) $f(x_1\text{-}x_2) = f(x_1) * f(x_2)$ b) $f(x_1*x_2) = f(x_1) . f(x_2)$

c) $f(x_1*x_2) = f(x_1) . 1/ f(x_2)$ d) $f(x_1.x_2) = f(x_1*x_2)$ **Ans : b**

26.Every cyclic group is

a.) Finite b) Abelian c) Normal d) Dihedral **Ans : b**

27.The order of a group G is 13, then the number of sub-groups of G is

a.) 1 b) 2 c) 4 d) 3 **Ans : b**

28.Name the semi-group (M,*) which has an identity element with respect to the operation on *

a.) Group b) Sub-group c) Monoid d) Cyclic **Ans : c**

29.Every sub-group of a cyclic group is

a.) Homomorphic b) Cyclic c) Isomorphic d) Abelian **Ans** : **b**

30. The minimum order of a non-abelian group is

a.) 3 b) 6 c) 9 d) 4 **Ans** : **b**

31. Every sub-group of abelian group is

a.) Normal b) Abelian c) Cyclic d) A permutation group. **Ans** : **a**

32. Which of the following is not an integral domain?

a) (N, +, .) b) (c, +, .) c) (O, +, .) d) (R, +, .) **Ans** : **a**

33**.** All integral domain S is

a) field when S is finite b) always a field c) never field d) field when S is infinite **Ans** : **a**

34. if (R, +, .) is a ring then that x.x = x ∀∀ x ∈∈ R, then

a) x + y = 0 ⇒⇒ x = y b) x + x ≠ 0 c) x ≠≠ y ⇒⇒ x + y = 0 d) x + x = 0 **Ans** : **a**

35**.** A ring of even integers is also a

a) field b) division ring c) integral domain d) ring with unity **Ans** : **c**

36. The condition for non-existence of zero divisor is

a) $a^2 = a, \ \forall \ a \in R$ b) the cellation law holds for multiplication in R

c) $(a+b)^2 = a^2 + 2ab + b^2, \forall \ a,b \in R$ d) $a^2 \neq a, \ \forall \ a \in R$ **Ans** : **b**

37. The ring Z of integers (mod p) is an integral domain iff

a) p is a positive integer b) p is purely even numbers c) p is odd d) p is prime **Ans** : **d**

38. Let $S = \{a_1, a_2, a_3\}, a_i \in Q$. Define addition and multiplication on S by

$(a_1, a_2, a_3) + (b_1, b_2, b_3) = (a_1 + b_1, a_2 + b_2, a_3 + b_3)$ and

$(a_1, a_2, a_3).(b_1, b_2, b_3) = (a_1 b_1, a_2 b_1 + a_3 b_2, a_3 b_3)$ then S is

a) A non commutative ring with unity (1, 0, 1) b) A commutative ring without unity

c). A non-commutative ring with unity (1, 0, 0) d) A non-commutative ring without unity **Ans** : **a**

39. If R is a system such that it is a group under addition and multiplication, obeys the closure and

distributive laws, then **Ans : b**

a) R need not be a ring b) R has to be a ring c) R is not a ring d) R is necessarily a field

40. Which one of the following statement is correct?

a) In a ring ab = 0 ⇒⇒ either a = 0 or b = 0 b) Every finite ring is an integral domain

c). Every finite integral domain is a field d) a ring with zero divisors **Ans : c**

41) Let R = {0, l, 2, 3, 4, 5), +6,x6} then R is

a) a ring with zero divisors b) a field c) a division ring d) a ring without zero divisors **Ans : a**

42) . The set of all 2××2 matrices over the field of real number under the usual addition and multiplication of matrices is

a) not a ring b) a ring with unity c) a commutative ring d) an integral domain **Ans : b**

43) If Q and Z are the sets of rational numbers and integers respectively, then which one of the following triples is a field?

a)(Q, +, x) b) (Q, -, x) c) (Z, +, x) d) (Z, -, x) **Ans : a**

44) If $x = 10011 \in B^5$ then weight of x , W(x) =

a) 2 b) 3 c) 5 d) 1 **Ans : b**

45) If $x = 10011 \in B^5$ then the length of x =

a) 2 b) 3 c) 5 d) 1 **Ans : c**

46) The Hamming distance between the codes x = 010000 and y = 000101 is

a) 3 b) 2 c) 6 d) 5 **Ans : a**

47) If $b = b_1 b_2 \ldots. b_{m,}$ $define\ e(b) = b_1 b_2 \ldots\ldots b_m b_{m+1},$ $where$ $b_{m+1} = \begin{cases} 0, & if\ \lfloor b \rfloor\ is\ even \\ 1, & if\ \lfloor b \rfloor\ is\ odd \end{cases}$ then

e(01010) = a) 110100 b) 010101 c) 010110 d) 010100 **Ans : d**

48) The minimum distance of encoding function is 2 then the number of errors it can detect is

a) 1 or less than 1 b) 2 or less than 2 c) 3 or less than three d) 0 error **Ans : a**

49) The minimum distance of encoding function is 3 then the number of errors it can correct is

a) 1 or less than 1 b) 2 or less than 2 c) 3 or less than three d) 0 error **Ans : d**

50) For an encoding function $e: B^m \to B^n$, *the generator matrix* $G = \begin{pmatrix} 1 & 0 & 0 & 1\,1\,0 \\ 0 & 1 & 0 & 0\,1\,1 \\ 0 & 0 & 1 & 1\,0\,1 \end{pmatrix}$ and the message

M = (0 1 1) then the code word is

a) [0 1 1 1 1 0] b) [0 1 0 1 1 0] c) [0 0 0 1 1 0] d) [0 1 1 1 0 0] **Ans: a**

51) In a group code { 00000, 10101 , 01110 , 11011} , the inverse of 11011 is

a) 01110 b) 00000 c) 11011 d) 01110 **Ans: c**

52) The value of $\begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} \oplus \begin{bmatrix} 1 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix} =$

a) $\begin{bmatrix} 0 & 1 & 0 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ b) $\begin{bmatrix} 0 & 1 & 0 \\ 1 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ c) $\begin{bmatrix} 0 & 1 & 0 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ d) $\begin{bmatrix} 0 & 1 & 0 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \\ 1 & 0 & 0 \end{bmatrix}$ **Ans: a**

53) Order of B^5 =

a) 5 b) 2 c) 32 d) 10 Ans: c

54) For an encoding function $e: B^m \to B^{3m}$, e(100) =

a) 100001100 b) 100100 001 c) 100100100 d) 100000000 Ans: c

55) The minimum weight of the non-zero code word in a group code is equal to its

a) maximum distance b) minimum distance c) equl distance d) Parity check code **Ans: b**

56.) The encoding function is

a) on-to function b) one to one function c) many to one function d) in to function **Ans: b**

57) The decoding function is

a) on-to function b) one to one function c) many to one function d) in to function **Ans: a**

Unit-5 Graph Theory

1. How many edges are there in a group with 10 vertices each of degree 6 ?

   a.) 30 b)60 c) 15 d) 16 **Ans : a**

2. The maximum number of edges in a simple graph with n vertices is

   a.) n(n-1)/2 b) n(n+1)/2 c) (n-1)(n+1)/2 d) n/2 **Ans : a**

3. A simple graph with n vertices and k components can have atmost ______ edges.

   a.) (n-k) (n-k-1)/2 b) (n-k) (n-k+1)/2 c) (n+k) (n+k-1)/2 d)(n+k) (n-k+1)/2 **Ans : b**

4. The complete graph on a vertices k_n where n>=3 is **Ans : a**

   a.) Hamiltonian b) Eulerian c) Both Hamiltonian and Eulerian d) Neither Hamiltonian and Eulerian

5. The maximum number of edges in a simple graph with 8 vertices is

   a.) 40 b) 32 c) 28 d) 8! **Ans : c**

6. A regular graph G has 10 edges and degree of any vertex is 5, then the number of vertices is

   a.) 4 b) 5 c) 6 d) 25 **Ans : a**

7. A closed directed path containing all the edges in a diagraph G is called an

   a.) Closed circuit b) Hamiltonian circuit c) Eulerian circuit d) Isomorphic circuit **Ans : c**

8. A free graph with n vertices has

   a.) n-1 edges b) atleast one loop c) n edges d) no root **Ans : a**

9. Sum of the degrees of all vertices of a group G is equal to

   a)Thrice the number of edges b) Twice the number of edges

   c) Number of edges d) Five times the number of the edges **Ans : b**

10. A connected graph without any circuit is called

a) Loop b) Bipartite graph c) Tree d) Directed graph **Ans : c**

11. Number of edges in k_6 graph is

a.) 16 b) 17 c) 15 d) 20 **Ans : c**

12. In a graph G, a path which includes each edge of G exactly once is called

a.) Eulerian path b) Hamiltonian path c) Eulerian circuit d) Hamiltonian circuit **Ans : a**

13. The maximum number of edges in a simple graph with 9 vertices is

a.) 36 b) 40 c) 32 d) 45 **Ans : a**

14. A regular graph G has 20 edges and degrees of any vertex is 10, then the number of vertices is

a.) 6 b) 4 c) 5 d) 8 **Ans : b**

15. Any connected graph with n vertices and n-1 edges is

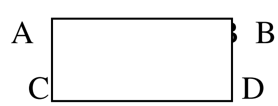
a.) Graph b) Closed graph c) Tree d) Spanning tree **Ans : c**

16. A path of a graph G is called _______ if it includes each vertices of G exactly once

a.) Tree b) Spanning tree c) Directed graph d) Hamiltonian path **Ans : a**

a.) If all the vertices of an undirected graph are each of odd degree 5, then the number of edges of the graph is a multiple of a) 3 b) 2 c) 5 d) 7 **Ans : a**

17. The graph G is



a)Eulerian and Hamiltonian b) Eulerian but not Hamiltonian

c)Hamiltonian but not Eulerian d) Neither Hamiltonian but not Eulerian **Ans : a**

18. A tree with 9 vertices has

a.) 7 edges b) 6 edges c) 10 edges d) 8 edges **Ans : d**

19. A connected graph is a Euler graph if and only if each of its vertices is of

a.) Odd degree b) Even degree c) Equal degree d) Increasing degree **Ans : b**

20. The number of vertices of odd degree in an undirected graph is

a.) Even b) Odd c) 4 d) 3 **Ans : a**

21. A simple graph is which there is exactly one edge between each pair of distinct vertices is

a.) Connected graph b) Bipartite graph c) Euler graph d) Complete graph **Ans : d**

22. Shortest path between two vertices in a weighted graph is a path of least

a.) Vertices b) Edges c) Weight d) Vertices and Edges. **Ans : c**

24. A graph in which all nodes are of equal degree is called

(a) Multi graph (b) non regular graph

(c) Regular graph (d) complete graph **Ans: c**

25. Two isomorphic graphs must have

(a) Same number of vertices (b) Same number of edges

(c) Equal number of vertices (d) all of these **Ans: d**

26.Total number of edges in a complete graph of vertices is

(a) n (b) $\frac{(n-1)}{2}$ (c) (d) $\frac{(n+1)}{2}$ **Ans: b**

27.Number of different rooted labelled trees with *n* vertices is

(a) 2^{n-1} (b) 2^n (c) n^{n-1} (d) n^n **Ans: c**

28.Maximum number of edges in a *n* node undirected graph without self-loops is

(a) n^2 (b) $\frac{(n-1)}{2}$ (c) -1 (d) $\frac{(n+1)}{2}$ **Ans: b**

29.The minimum number of spanning trees in a connected graph with *n* nodes is

(a) 1 (b) n-1 (c) (d) 2 **Ans: d**

30.The length of a Hamiltonian path(if exists) in a connected graph of n vertices is

(a) n-1 (b) n (c) (d) n+1 **Ans: a**

31. A given connected graph G is a Euler graph if and only if all vertices of G are of

(a) Same degree (b) even degree

(c) Odd degree (d) different degrees **Ans: b**

32. A graph is a tree if and only if

(a) Is completely connected (b) is minimally connected

(c) Contains a circuit (d) is planar **Ans: b**

33. The degree of each vertex in K_n is

a) n-1 (b) n (c) n-2 (d) 2n-1 **Ans: a**

34. Number of vertices of ODD degree in a graph is

(a) Always EVEN (b) Always ODD

(c) Either EVEN or ODD (d) Always ZERO **Ans: a**

35. A graph in which all nodes are of equal degree is called

(a) Multi graph (b) non regular graph

(c) Regular graph (d) complete graph **Ans: c**

36. K_n denotes _______graph.

a) Regular (b) Simple (c) Complete (d) Null **Ans: C**

37. Maximum number of edges in an n-node undirected graph without self loops is ____.

a) $\frac{n(n-1)}{2}$ (b) n - 1 (c) n (d) $\frac{n(n+1)}{2}$ **Ans: a**

38. A graph is bipartite if and only if its chromatic number is ________.

a) 1 (b) 2 (c) Odd (d) Even **Ans: b**

39. For a symmetric digraph, the adjacency matrix is _________.

a) Symmetric (b) Anti symmetric (c) asymmetric d) Symmetric & asymmetric **Ans: C**

40. The chromatic number of the chess board is ______.

a) 1 (b) 2 (c) 3 (d) 4 **Ans: b**

41. The total number of degrees of an isolated node is _______.

a) 0 (b) 2 (c) 3 (d) 1 **Ans: a**

42. Every non-trivial tree has at least _____ vertices of degree one.

a) 4 (b) 2 (c) 3 (d) 1 **Ans: b**

43. Every connected graph contains a ________.

a)Tree (b) Sub Tree (c) Spanning tree d) Spanning sub tree **Ans: C**

44. Hamilton cycle is a cycle that contains every ________of G

a) Path (b) Cycle (c) Vertex d) Edge **Ans: C**

45. Edges intersect only at their ends are called ________.

a) Planar (b) Loop (c) Link d) Non-Planar **Ans: a**

46. Two vertices which are incident with the common edge are called ______________vertices.

a) Distinct (b) Loop (c) Direct d) Adjacent **Ans: d**

47. An edge with identical ends is called _________.

a) Distinct (b) Loop (c) Direct d) Adjacent **Ans: b**

48. Each edge has one end in set X and one end in set Y then the graph (X, Y) is called _____graph.

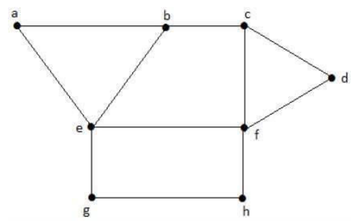
a) Bipartite (b) Simple (c) Complete (d) Trivial **Ans: a**

49. The graph defined by the vertices and edges of a __________ is bipartite.

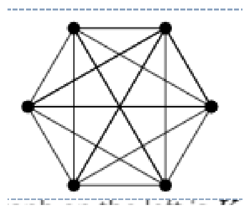
a) Square (b) Cube (c) Rectangle (d) Square and Rectangle **Ans: b**

50.The chromatic number of the null graph is

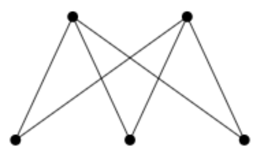
a) 4 (b) 2 (c) 3 (d) 1 **Ans: d**

51.The chromatic number of the region  is

a) 4 (b) 2 (c) 3 (d) 1 **Ans: b**

52. The chromatic number of the graph  is

a) 4 (b) 2 (c) 3 (d) 6 **Ans: d**

53. The chtomatic number of the graph  is

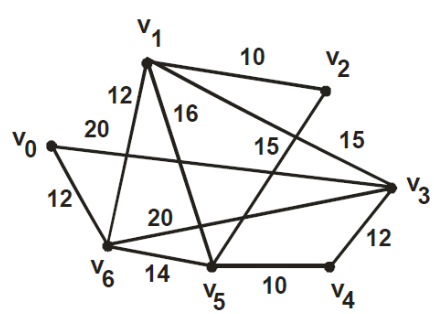
a) 4 (b) 2 (c) 3 (d) 6 **Ans: b**

54. Graph G is 2-colourable iff G is

a) Bipartite (b) Simple (c) Complete (d) Trivial **Ans: a**

55. The chromatic number of the graph  is

a) 4 (b) 2 (c) 3 (d) 6 **Ans: b**

56. The minimum weight of the spanning treevfor the graph  is

a) 60 (b) 70 (c) 50 (d) 80 **Ans: b**

KTR CT-2 Question paper

1. The minimum number of students in a class to be sure that three of them are born in the same month is

A. 22
B. 23
C. 24
D. 25

ANSWER: D

2. In how many ways can two letters be selected from the set {a, b, c, d} when repetition of the letters is allowed, if the order of the letters matters?

A. 10
B. 20
C. 12
D. 16

ANSWER: D

3. The number of ways in which n persons can be seated round a table is

A. n!
B. (n - 1)!
C. (n + 1)!
D. (n + 2)!

ANSWER: B

4. From a club consisting of 6 men and 7 women, in how many ways can we select a committee of 3 men and 4 women

A. 750
B. 700
C. 850
D. 600

ANSWER: B

5. If n pigeonholes are occupied by kn + 1 pigeons, where k is a positive integer, then atleast one pigeonhole is occupied by

A. k pigeons
B. k + 1 pigeons
C. k - 2 pigeons
D. k - 3 pigeons

ANSWER: B

6. Using pigeonhole principle, find how many people in any group of six people can be
   A. at least 2 must be mutual friends
   B. at least 2 must be mutual strangers
   C. at least 3 must be mutual friends or at least 3 must be mutual strangers
   D. no group can be formed

ANSWER: C

7. Of any five points chosen within an equilateral triangle whose sides are of length one, then the any two points are within a distance of
   A. 2 distance apart
   B. 1/3 of each other
   C. 1/2 of each other
   D. 1/4 of each other

ANSWER: C

8. There are 250 students in a college. Of these 188 have taken a course in Mathematics, 100 have taken a course in English and 35 have taken a course in Science. Further 88 have taken courses in both Mathematics and English. 23 have taken courses in both English and Science and 29 have taken courses in both Mathematics and Science. If 19 of these students have taken all the three courses, how many of these 250 students have not taken a course in any of these three courses?
   A. 140
   B. 202
   C. 58
   D. 48

ANSWER: D

9. Using the inclusion-exclusion principle, find the number of integers from a set of 1 to 100 that are not divisible by 2, 3 and 5.
   A. 22
   B. 25
   C. 26
   D. 33

ANSWER: C

10. Let $a, b, c \in Z$, the set of integers. If $a \mid b$ and $a \mid c$, then
   A. $b \mid ma$
   B. $b \mid na$
   C. $(m+n) \mid b+c$
   D. $a \mid (mb+cn)$

ANSWER: D

11. If n > 1 is a composite integer and *p* is a prime factor of *n*, then
   A. $p \geq \sqrt{n}$
   B. $p \leq \sqrt{n}$
   C. $p < \sqrt{n}$
   D. $p > \sqrt{n}$

ANSWER: B

12. If *a* and *b* are coprime and *a* and *c* are coprime, then
   A. *ab* and *bc* are coprime
   B. *a* is not prime
   C. *a* and *bc* are coprime
   D. *a* and *bc* are not coprime

ANSWER: C

13. If a and b are any two integers, b>0, there exists unique integers q and r such that $a = bq + r$, where
   A. $a \leq r < b$
   B. $0 > r > b$
   C. $r < 0$
   D. $b = 0$

ANSWER: A

14. Fundamental Theorem of Arithmetic states that
   A. Every integer n > 1 can be written as a sum of prime numbers
   B. Every integer n > 1 can be written as a product of composite numbers
   C. Every integer n > 1 can be written uniquely as a product of prime numbers
   D. Every integer n < 1 can be written uniquely as a product of prime numbers

ANSWER: C

15. If the prime factorization of *a* and *b* are $a = p_1^{a_1}.p_2^{a_2}.p_3^{a_3}...p_n^{a_n}$ and $b = p_1^{b_1}.p_2^{b_2}.p_3^{b_3}...p_n^{b_n}$, where each exponent is a non-negative integer then
   A. $\gcd(a,b) = p_1^{\min(a_1,b_1)}.p_2^{\min(a_2,b_2)}.p_3^{\min(a_3,b_3)}...p_n^{\min(a_n,b_n)}$
   B. $\gcd(a,b) = p_1^{\max(a_1,b_1)}.p_2^{\max(a_2,b_2)}.p_3^{\max(a_3,b_3)}...p_n^{\max(a_n,b_n)}$
   C. $\gcd(a,b) = p_1.p_2.p_3...p_n$
   D. $\gcd(a,b) = a\,b$

ANSWER: A

16. Which of the following is pairwise relatively prime numbers?
    A. (6, 12, 22, 27)
    B. (121, 122, 123)
    C. (30, 42, 70, 105)
    D. (10, 19, 24)

ANSWER: B

17. The gcd (1819, 3587) is
    A. 21
    B. 19
    C. 17
    D. 11

ANSWER: C

18. Using prime factorization find the gcd and lcm of (231, 1575)
    A. 21, 17325
    B. 19, 2100
    C. 17, 1525
    D. 21, 1570

ANSWER: A

19. If *a* and *b* are two positive numbers, then the product of gcd (a, b) and lcm (a, b) is
    A. a^2b^2
    B. ab
    C. a^2b
    D. ab^2

ANSWER: B

20. The lcm (a, b) is always __________ if either or both *a* and *b* are negative
    A. prime
    B. negative
    C. neither positive nor negative
    D. positive

ANSWER: D

21. Find the integers *m* and *n* in $512m + 320n = 64$.
    A. m = 2, n = -3
    B. m = -3, n = 2
    C. m = -2, n = -3

D. m = -3, n = -2

ANSWER: A

22. If $\gcd(a, b) = d$ then
    A. $\gcd(ad, bd) = 1$
    B. $\gcd(\frac{d}{a}, \frac{d}{b}) = 1$
    C. $\gcd(a, b) = 1$
    D. $\gcd(\frac{a}{d}, \frac{b}{d}) = 1$

ANSWER: D

23. If $\gcd(a, b) = 1$ then for any integer *c*
    A. $\gcd(ac, b) = \gcd(c, b)$
    B. $\gcd(a, bc) = \gcd(c, b)$
    C. $\gcd(a, b) = \gcd(c, b)$
    D. $\gcd(a, bc) = 1$

ANSWER: A

24. If a = qb + r, then
    A. gcd (a, r) = gcd (b, r)
    B. gcd (a, b) = gcd (a, r)
    C. gcd (a, r) = gcd (b, r)
    D. gcd (a, b) = gcd (b, r)

ANSWER: D

25. If an event can occur in *m* ways and a second event in *n* ways and if the number of ways the second event occurs does not depend upon the occurrence of the first event, then the two events can occur simultaneously in
    A. m ways
    B. n ways
    C. m + n ways
    D. mn ways

ANSWER: D

26. $p \leftrightarrow q$ is equivalent to

A. $(\neg p \vee q) \wedge (\neg q \vee p)$

B. $(p \vee \neg q) \wedge (\neg p \wedge q)$

C. $(p \vee q) \wedge (\neg p \vee q)$

D. $(p \wedge q) \wedge (\neg p \wedge q)$

ANSWER: A

27. In the conclusion of the any given compound proposition if all the entries are false, then it is called a

A. Tautology

B. contradiction

C. negation

D. contrapositive

ANSWER: B

28. $P \vee T$ is equivalent to

A. neither T nor F

B. p

C. T

D. F

ANSWER: C

29. $(p \rightarrow r) \wedge (\mathrm{q} \rightarrow \mathrm{r}) \equiv$

A. $(p \vee q) \rightarrow r$

B. $(p \wedge q) \rightarrow r$

C. $p \rightarrow (q \wedge r)$

D. $p \rightarrow (q \vee r)$

ANSWER: A

30. $p \vee q$ is equivalent to

A. $p \to q$

B. $p \to \neg q$

C. $\neg p \to q$

D. $\neg p \to \neg q$

ANSWER: C

31. The value of the proposition $p \wedge (p \vee q)$ is

A. p

B. $p \vee q$

C. q

D. $p \wedge q$

ANSWER: A

32. The truth table for $(p \vee q) \vee \neg p$ is

A. Tautology

B. Contradiction

C. Converse of $p \to q$

D. Negation of P.

ANSWER: A

33. Which of the following proposition is equivalent?

A. $\neg(p \leftrightarrow q) \equiv p \leftrightarrow \neg q$

B. $p \leftrightarrow q \equiv (p \to q) \vee (q \to p)$

C. $p \to q \equiv p \vee \neg q$

D. $p \leftrightarrow q \equiv \neg p \leftrightarrow q$

ANSWER: A

34. Let p: food is good, q: food is cheap, the symbolic form of the statement "good food is not cheap" is

A. $p \wedge q$

B. $p \to q$

C. $\neg p \to q$

D. $p \to \neg q$

ANSWER: D

35. The truth table for $\neg(\neg p \vee \neg q)$ is

A. $\begin{matrix} T \\ T \\ T \\ T \end{matrix}$ B. $\begin{matrix} T \\ F \\ F \\ F \end{matrix}$ C. $\begin{matrix} F \\ F \\ F \\ F \end{matrix}$ D. $\begin{matrix} T \\ F \\ T \\ F \end{matrix}$

ANSWER: B

36. The truth table for $(p \to q) \to (\mathrm{q} \to p)$ is

A. $\begin{matrix} T \\ F \\ F \\ T \end{matrix}$ B. $\begin{matrix} T \\ T \\ F \\ T \end{matrix}$ C. $\begin{matrix} T \\ F \\ F \\ F \end{matrix}$ D. $\begin{matrix} F \\ F \\ F \\ F \end{matrix}$

ANSWER: B

37. $(p \to q) \wedge (p \to r)$ is equivalent to

A. $p \to q$

B. $p \to r$

C. $p \wedge (q \to r)$

D. $p \to (q \wedge r)$

ANSWER: D

38. If $A : (\neg \mathrm{p} \vee \mathrm{r}) \wedge (\neg q \vee \mathrm{r})$ then the duality of A is

A. $(\mathrm{p} \vee \mathrm{r}) \vee (q \vee \mathrm{r})$

B. $(\mathrm{p} \wedge \mathrm{r}) \vee (q \wedge \mathrm{r})$

C. $(\neg \mathrm{p} \wedge \mathrm{r}) \vee (\neg q \wedge \mathrm{r})$

D. $(\mathrm{p} \wedge \mathrm{r}) \vee (q \wedge \mathrm{r})$

ANSWER: C

39. The truth table for $(\neg q \wedge (p \to q)) \to \neg p$ is equivalent to

A.	B.	C.	D.
F	T	T	T
F	F	T	T
F	F	F	T
F	F	F	T

ANSWER: D

40. The conclusion of the premises $r \to d$, $t \to \neg d$ and t is

A. $\neg r$

B. $\neg d$

C. $\neg t$

D. r

ANSWER:A

41. A set of premises $R_1, R_2, ...R_n$ is said to be an inconsistent if their conjunction implies a _________

A. Conditional statement

B. Tautological implication

C. Contradiction

D. Tautology

ANSWER: C

42. If the premises are $p \to q, q \to \neg r, r$ and $p \vee (t \wedge s)$ then the conclusion is

A. $p \vee q$

B. $t \wedge s$

C. $q \vee s$

D. $p \wedge q$

ANSWER: B

43. The conclusion of the premises are $(a \to b) \wedge (a \to c), \neg(\mathrm{b} \wedge \mathrm{c})$ and $(\mathrm{d} \vee \mathrm{a})$ is

A. b

B. a

C. d

D. c

ANSWER: C

44. Symbolize the statement, p: It's raining; q: I get wet, "If I do not get wet then it is not raining".

A. $p \to q$

B. $q \to p$

C. $\neg p \to \neg q$

D. $\neg q \to \neg p$

ANSWER: D

45. Let p: its rain; q: there is traffic dislocation, r: sports day will be held, s: cultural programmes will go on. The symbolic form of the statement is "If it does not rain or if there is no traffic dislocation then the sports day will be held and the cultural programme will go on"

A. $\neg p \vee \neg q$

B. $\neg q \to \neg p$

C. $(\neg p \vee \neg q) \to r \wedge s$

D. $(\neg q \to \neg p) \to r \wedge s$

ANSWER: C

46. The conclusion for the set of premises $p \to q, q \to r, s \to \neg r$ and $q \wedge s$ is

A. $\mathrm{p} \wedge q$

B. $q \wedge r$

C. $s \wedge \neg r$

D. inconsistent

ANSWER: D

47. The conclusion of the premises $p \to (q \vee r), (q \to \neg p), (s \to \neg r)$ and p is

A. $p \to s$

B. $\neg s \rightarrow p$

C. $p \wedge s$

D. $p \rightarrow \neg s$

ANSWER: D

48. The conclusion of the premises are $\mathrm{r} \rightarrow \neg q, r \vee s, s \rightarrow \neg q$ and $p \rightarrow q$ is

A. r

B. $\neg p$

C. $\neg r$

D. $\neg q$

ANSWER: B

49. The conclusion of the premises $p \rightarrow (q \rightarrow s), \neg r \vee p$ and q is

A. $r \rightarrow s$

B. $r \wedge s$

C. $r \vee s$

D. $s \rightarrow r$

ANSWER: A

50. Let $P(K) = 3^K + 7^K - 2$ then P(K+1) is divisible by

A. 5

B. 6

C. 7

D. 8

ANSWER: D

1. If a set ‘A’ has n elements then the power set of A has —— elements

   A. n

   B. n^2

   C. 2^n

   D. 3^n

   ANSWER: C

2. If A, B and C are sets then $A \times (B \cup C)$ is ———

   A. $(A \cap B) \times (A \cap C)$

   B. $(A \times B) \cap (B \times C)$

   C. $(A \times B) \cup (A \times C)$

   D. $(A \times B) \cup (B \times C)$

   ANSWER: C

3. If the relation R is reflexive, symmetric and transitive then the relation R is called ———

   A. poset

   B. equivalence relation

   C. partial order relation

   D. equivalance classes

   ANSWER: B

4. In a poset, the greatest and least element if they exist are ——

   A. more than one

   B. zero

   C. exactly two

   D. unique

   ANSWER: D

5. Determine which of the following relations is a function with domain $\{1, 2, 3, 4\}$ ———

   A. $\{(1, 1), (2, 1), (3, 1), (4, 1), (3, 3)\}$

   B. $\{(1, 2), (2, 3), (4, 2)\}$

   C. $\{(1, 4), (2, 3), (3, 2), (4, 1)\}$

   D. $\{(1, 1), (3, 2), (4, 1)\}$

   ANSWER: C

6. Which of the following subsets forms a partition for $S = \{1, 2, 3, 4, 5, 6\}$ is ———

   A. $\{\{1, 3, 5\}, \{2, 4\}\}$

   B. $\{\{1, 3\}, \{3, 5\}, \{2, 4, 6\}\}$

   C. $\{\{1, 2, 3\}, \{4, 5\}, \{6\}\}$

   D. $\{\{1\}, \{1, 3, 5\}, \{2, 4, 6\}\}$

   ANSWER: C

7. If the relation R is defined on set of all integers as $R = \{(a, b)|ab \geq 0\}$ then R is

   A. reflexive and transitive

   B. symmetric and transitive

   C. transitive but not reflexive

   D. reflexive and symmetric

   ANSWER: D

8. Let $R = \{(1, 1), (1, 3), (3, 2), (3, 4), (4, 2)\}$ and $S = \{(2, 1), (1, 3), (3, 4), (4, 1)\}$ then $R \bullet S$ is

   A. $\{(1, 3), (1, 4), (3, 1)\}$

   B. $\{(1, 3), (1, 4), (3, 1), (4, 1)\}$

C. $\{(1,1),(1,3),(4,1)\}$

D. $\{(1,3),(3,1),(4,1)\}$

ANSWER: B

9. If M_R and M_S be the matrix representation of a relation R and S then $M_{R\oplus S}$ is ———

A. $M_R + M_S$

B. $M_{R\cup S}$

C. $M_{R\cap S}$

D. $M_{R\cup S} - M_{R\cap S}$

ANSWER: D

10. If $A = \{1, 2, 3\}, B = \{w, x, y, z\}$ and $f : A \to B$ then how many functions of f are there ———

A. 4

B. 8

C. 16

D. 64

ANSWER: D

11. If the function $f : A \to B$ is invertible then f is ————

A. one to one

B. onto

C. bijective

D. many to one

ANSWER: C

12. Equivalence class of $'a'$ under the relation R is defined as

A. $\{x|(a, x) \in R\}$

B. $\{x|(x, a) \in R\}$

C. $\{a|(a, x) \in R\}$

D. $\{a|(x, a) \in R\}$

ANSWER: A

13. If $f : R \to R$ is given by $f(x) = x^3 - 2$ then f^{-1} is ———

A. $(x - 2)^3$

B. $(x - 2)^{\frac{1}{3}}$

C. $(x^3 + 2)^{\frac{1}{3}}$

D. $(x + 2)^{\frac{1}{3}}$

ANSWER: D

14. If $S = \{1, 2, 3, 4, 5\}$ and the function $f : S \to S$ is given by $f = \{(1, 2), (2, 1), (3, 4), (4, 5), (5, 3)\}$ then f^{-1} is

A. $\{(2, 1), (1, 2), (4, 3), (5, 4), (3, 5)\}$

B. $\{(4, 3), (5, 4)\}$

C. $\{(2, 1), (1, 2), (4, 3)\}$

D. $\{(2, 1), (1, 2), (4, 3), (5, 4)\}$

ANSWER: A

15. If $f : A \to B$ and $g : B \to A$ then $g \circ f$ is

A. I_A

B. many one

C. I_B

D. does not exist

ANSWER: A

16. In the generalization of a Pigeohole principle if the n pigeons are accomodated in 'm' holes then ———-

    A. $n \leq m$

    B. $n \geq m$

    C. $n < m$

    D. $n > m$

    ANSWER: D

17. The dual of $A = (\bar{B} \cap A) \cup (A \cap B)$

    A. $A = (\bar{B} \cup A)$

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

    C. $A = (\bar{B} \cup A) \cap (A \cup B)$

    D. $A = \phi$

    ANSWER: C

18. If A is the universal set with n elements and $B_1, B_2, \cdots, B_m$ be the subsets of A then the number of minsets generated by $B_1, B_2, \cdots, B_m$ is ———-

    A. n

    B. 2^m

    C. 2^n

    D. m

    ANSWER: B

1. If A and B are sets, then $(A - B) \cup (A \cap B)$ equals

   A. ϕ

   B. B

   C. $A \cap B$

   D. A

   ANSWER: D

2. Let $A = \{1, 2, 3\}, B = \{2, 3, 4\}, C = \{4, 5, 6\}$ and $D = \{6, 7, 8\}$. Then $(A \times C) \cap (B \times D)$ is ——

   A. $\{(2, 6), (3, 6)\}$

   B. $\{(2, 6), (2, 7), (3, 6), (3, 8)\}$

   C. $\{(2, 6), (2, 7), (2, 8), (3, 6)\}$

   D. $\{(2, 6), (2, 7), (3, 7), (3, 8)\}$

   ANSWER: A

3. If the set 'A' has n elements then the number of possible subsets of $A \times A$ is ———

   A. n^2

   B. 2^n

   C. 2^{n^2}

   D. n

   ANSWER: C

4. If $R_1 = \{(1, 2), (2, 3), (3, 4)\}$ and $R_2 = \{(1, 1), (1, 2), (2, 1), (2, 2), (2, 3), (3, 1), (3, 2), (3, 3), (3, 4)\}$ be the relations from $\{1, 2, 3\}$ to $\{1, 2, 3, 4\}$ then ———-

   A. $R_1 \cup R_2 = R_1$

   B. $R_1 \cap R_2 = R_2$

C. $R_1 - R_2 = \phi$

D. $R_2 - R_1 = \phi$

ANSWER: C

5. The union of two equivalence relation is ———-

A. equivalance relation

B. equivalance class

C. partial ordering relation

D. not necessarily an equivalance relation

ANSWER: D

6. If no vertex has loop in a digraph of a relation R, then R is

A. reflexive

B. irreflexive

C. symmetric

D. antisymmetric

ANSWER: B

7. For the poset $[\{2, 3, 5, 30, 60, 120, 180, 360\}; divisor of]$, the minimal elements are

A. 2, 3, 5, 30

B. 2, 5

C. 2, 3, 5

D. 2, 3

ANSWER: C

8. If $R = \{(x, x^2)\}$ and $S = \{(x, 2x)\}$, where x is a non - negative integer, then $R \cap S$ equals

A. $\{(0, 0)\}$

B. does not exist

C. $\{(1, 2), (3, 4)\}$

D. $\{(0, 0), (2, 4)\}$

ANSWER: D

9. If g is a function from R to R defined by $g(x) = -2x + 6$, then $g^{-1}(4)$ equals

A. -1

B. 3

C. 1

D. 2

ANSWER: C

10. If $f, g : R \to R$ are defined by$f(x) = x + 2$ and $g(x) = 3x$, then $f \circ g$ equals

A. $x + 2$

B. $3x$

C. $3x + 2$

D. $3x^2 + 2$

ANSWER: C

11. If f is a function from $S = \{0, 1, 2, 3, 4, 5\}$ to S defined by $f(x) = (4x)$ mod 6, then the ordered pairs of f equals

A. $\{(0, 0), (1, 4), (2, 2)\}$

B. $\{(0, 0), (1, 4), (2, 2), (3, 0), (4, 4), (5, 2)\}$

C. $\{(0, 5), (1, 3), (3, 0), (4, 4), (5, 2), (1, 4)\}$

D. $\{(0, 0), (1, 1), (2, 2), (3, 3)(4, 4), (5, 5)\}$

ANSWER: B

12. If $f : R \to R$ defined by $f(x) = 3x^3 + x$, then f is

A. neither one to one nor onto

B. onto but not one to one

C. both one to one and onto

D. one to one but not onto

ANSWER: C

1. The transitive closure of the relation $R = \{(1,2),(2,3),(3,3)\}$ on the set $A = \{1,2,3\}$ equals

   A. $\{(1,2),(1,3)\}$

   B. $\{(1,3),(2,3),(3,3)\}$

   C. $\{(1,2),(1,3),(2,3),(3,3)\}$

   D. $\{(1,2),(1,3),(2,3)\}$

   ANSWER: C

2. Consider a relation $R = \{(1,1),(2,1),(2,2),(2,3),(3,3)\}$ defined on $A = \{1,2,3\}$. The complement R' equals

   A. $\{(1,2),(3,2)\}$

   B. $\{(1,1),(2,2),(3,3)\}$

   C. $\{(1,2),(1,3),(3,1)\}$

   D. $\{(1,2),(1,3),(3,1),(3,2)\}$

   ANSWER: D

3. If $f : Z \to N$ is defined by $f(x) = \begin{cases} 2x-1, \quad x > 0 \\ -2x, \; x \leq 0 \end{cases}$ then

   A. $f^{-1}(x) = \begin{cases} x/2, \quad x = 1,3,5,\cdots \\ -x/2, \; x = 0,2,4,6,\cdots \end{cases}$

B. $f^{-1}(x) = \begin{cases} \frac{x+1}{2}, & x = 1, 3, 5, \cdots \\ -\frac{x}{2}, & x = 0, 2, 4, 6, \cdots \end{cases}$

C. $f^{-1}(x) = \begin{cases} \frac{x-1}{2}, & x = 1, 3, 5, \cdots \\ \frac{x+1}{2}, & x = 0, 2, 4, 6, \cdots \end{cases}$

D. $f^{-1}(x) = \begin{cases} \frac{x+1}{2}, & x = 1, 3, 5, \cdots \\ \frac{x-1}{2}, & x = 0, 2, 4, 6, \cdots \end{cases}$

ANSWER: B

4. If there are 5 points inside a square of side length 2, then two of the points are within a distance of ——- of each other

A. $\sqrt{2}$

B. $\sqrt{3}$

C. $\sqrt{5}$

D. $\sqrt{7}$

ANSWER: A

5. If $M_R = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 1 & 1 \\ 1 & 0 & 0 \end{pmatrix}$ and $M_S = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{pmatrix}$ then $M_{R \circ S}$ is

A. $\begin{pmatrix} 1 & 0 & 1 \\ 1 & 1 & 1 \\ 0 & 1 & 0 \end{pmatrix}$

B. $\begin{pmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix}$

C. $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$

D. $\begin{pmatrix} 0 & 1 & 1 \\ 1 & 1 & 1 \\ 0 & 1 & 0 \end{pmatrix}$

ANSWER: D

6. If $f, g, h : R \to R$ are defined by $f(x) = x^3 - 4x, g(x) = \frac{1}{x^2+1}$ and $h(x) = x^4$, then $\{(f \circ g) \circ h\}(x)$ equals

A. $(x^8 + 1)^3 - 4(x^8 + 1)$

B. $(x^8 + 1)^{-3} - 4(x^8 + 1)^{-1}$

C. $(x^7 + 1)^{-3} - 4(x^7 + 1)^{-1}$

D. $(x^7 + 1)^3 - 4(x^7 + 1)$

ANSWER: B

1. Which of the following sentence is a proposition?

   A. What is the height of Himalaya?

   B. Close the door

   C. How beautiful is Rose?

   D. New Delhi is the capital city of India

   ANSWER: D

2. Propositions which do not certain any of the logical operators or connectives are called

   A. atomic propositions

   B. compound propositions

   C. conditional propositions

   D. biconditional propositions

   ANSWER: A

3. A compound proposition $P = P(p_1, p_2, \cdots, p_n)$ where $p_1, p_2, \cdots, p_n$ are variables is called a ________ if it is true for every truth assignment for $p_1, p_2, \cdots, p_n$.

   A. contradiction

   B. tautology

   C. quantifiers

   D. tautological implication

   ANSWER: B

4. The statement which contain one or more atomic statements and some connective are called ________

   A. atomic statement

   B. conditional statement

   C. biconditional statement

   D. molecular statements

   ANSWER: D

5. A compound proposition $P = P(p_1, p_2, \cdots, p_n)$ where $p_1, p_2, \cdots, p_n$ are variables is called a ——— if it is false for every truth assignment for $p_1, p_2, \cdots, p_n$.

   A. tautology

   B. universal quantifier

   C. contradiction

   D. conditional propositions

   ANSWER: C

6. The dual of $((P \vee Q) \wedge R) \vee T$ is

   A. $((P \vee Q) \vee R) \vee T$

   B. $((P \wedge Q) \vee R) \wedge T$

   C. $((P \wedge Q) \vee R) \wedge F$

   D. $((P \vee Q) \wedge R) \vee F$

   ANSWER: C

7. A premise may be introduced at any point in the derivation is called ________

   A. Rule P

   B. Rule T

   C. Rule P and rule T

   D. Rule C

   ANSWER: A

8. $p \to q$ is logically equivalent to

   A. $\neg p \to \neg q$

   B. $\neg p \to q$

   C. $\neg p \wedge q$

   D. $\neg p \vee q$

   ANSWER: D

9. The contrapositive of $q \to p$ is

   A. $p \to q$

   B. $\neg p \to \neg q$

   C. $\neg q \to \neg p$

   D. $\neg p \to q$

   ANSWER: B

10. The proposition $(p \vee q) \leftrightarrow (q \vee p)$ is a

A. universal quantifier

B. existential quantifier

C. contradiction

D. tautology

ANSWER: D

11. The symbolic form of the statement “Every book with a blue cover is a mathematics book” is

A. $\exists x(B(x) \to M(x))$

B. $\forall x(B(x) \to M(x))$

C. $\forall x(B(x) \wedge M(x))$

D. $\exists x(B(x) \wedge M(x))$

ANSWER: B

12. The set of premises is said to be ________ if their conjunction implies a contradiction

A. tautology

B. consistent

C. inconsistent

D. universe of discourse

ANSWER: C

13. The symbolic form of the following is “If Raja takes calculus or Anand takes analytical geometry then Arun will take English”

A. $(p \vee q) \rightarrow r$

B. $(p \vee q) \wedge r$

C. $p \vee (q \rightarrow r)$

D. $p \wedge (q \rightarrow r)$

ANSWER: A

14. When a quantifier is used on a variable x or when we have to assign a value to this variable to get a proposition, the occurence of the variable is said to be ________

A. universal specification

B. existential specification

C. free variable

D. bound variable

ANSWER: D

15. The disjunctive syllogism rule is given by

A. $[(p \wedge q) \wedge \neg p] \rightarrow q$

B. $[(p \vee q) \wedge \neg p] \rightarrow q$

C. $[p \wedge (p \rightarrow q)] \rightarrow q$

D. $[\neg q \wedge (p \rightarrow q)] \rightarrow \neg p$

ANSWER: B

16. $P \vee F$ is equivalent to

A. P

B. T

C. F

D. $\forall x P(x)$

ANSWER: A

17. $\neg \exists x P(x)$ is equivalent to

A. $\exists x P(x)$

B. $\forall x P(x)$

C. $\forall x \neg P(x)$

D. $\exists x \neg P(x)$

ANSWER: C

18. The modus ponen rule is

A. $[\neg p \wedge (p \rightarrow q)] \rightarrow q$

B. $[p \wedge (p \rightarrow q)] \rightarrow q$

C. $[p \wedge (\neg p \rightarrow q)] \rightarrow q$

D. $[p \wedge (p \rightarrow \neg q)] \rightarrow q$

ANSWER: B

1. Let p: It rains

    q: the crops will grow. The converse of "If it rains then the crops will grow" is

    A. If the crops grow, then there has been rain

    B. If the crops do not grow then it will not rain

    C. If it does not rain then the crops will not grow

    D. The crops will grow if and only if it rains

    ANSWER: A

2. $p \leftrightarrow q$ is logically equivalent to

    A. $(p \to q) \vee (q \to p)$

    B. $(p \to q) \wedge (q \to p)$

    C. $p \to q$

    D. $q \to p$

    ANSWER: B

3. The proposition $p \wedge (q \wedge \neg p)$ is a

    A. tautology

    B. tautological implication

    C. contradiction

    D. biconditional statement

    ANSWER: C

4. For every positive integer $n, n^3 + n$ is

   A. a prime number

   B. odd number

   C. neither odd nor even number

   D. even number

   ANSWER: D

5. $((p \vee q) \wedge (p \rightarrow r) \wedge (q \rightarrow r)) \rightarrow r$ is a

   A. tautology

   B. contradiction

   C. universal quantifier

   D. existential quantifier

   ANSWER: A

6. The proposition $p \rightarrow (q \rightarrow r) \equiv$

   A. $p \wedge q$

   B. $(p \wedge q) \rightarrow r$

   C. r

   D. T

   ANSWER: B

7. The conclusion from the set of premises $p \rightarrow q, q \rightarrow r$ and p is

A. p

B. q

C. r

D. $p \wedge q$

ANSWER: C

8. The set of premises $a \rightarrow (b \rightarrow c), d \rightarrow (b \wedge \neg c)$ and $a \wedge d$ are

A. homogeneous

B. dependable

C. consistent

D. inconsistent

ANSWER: D

9. The symbolic form of the statement " All men are mortal " is

A. $\forall x(M(x) \rightarrow H(x))$

B. $\exists x(M(x) \rightarrow H(x))$

C. $\forall x(M(x) \wedge H(x))$

D. $\exists x(M(x) \vee H(x))$

ANSWER: A

10. The negation of the statement “Some students live in hostel” is

A. some students do not live in hostel

B. all students do not live in hostel

C. all students live in hostel

D. some students may or may not live in hostel

ANSWER: B

11. Symbolize the following premise “A student in this class has not read discrete mathematics text book”

A. $\forall x(C(x) \vee \neg D(x))$

B. $\forall x(C(x) \wedge \neg D(x))$

C. $\exists x(C(x) \wedge \neg D(x))$

D. $\exists x(C(x) \vee \neg D(x))$

ANSWER: C

12. For all $n \geq 1, n^5 - n$ is divisible by

A. 11

B. 7

C. 23

D. 5

ANSWER: D

1. Which of the following compound proposition is a tautology?

   A. $\neg(q \to r) \land r \land (p \to q)$

   B. $\neg(p \lor q) \land (p \lor r)$

   C. $(p \land q) \to (p \lor q)$

   D. $\neg(p \lor (q \land r)) \leftrightarrow ((p \lor q) \land (p \to r))$

   ANSWER: C

2. $\neg(p \lor (\neg p \land q))$ is equivalent to

   A. $\neg p \land q$

   B. $\neg p \land \neg q$

   C. $p \land \neg q$

   D. $p \land q$

   ANSWER: B

3. ________ can be derived from the premises, $a \to b, c \to b, d \to (a \lor c)$ and d

   A. b

   B. c

   C. d

   D. a

   ANSWER: A

4. The negation of the following statement “Some of the students do not keep quiet or the teacher is absent” is

   A. $Q(x)$

   B. $\exists x Q(x)$

   C. $\forall x Q(x) \wedge \exists x Q(x)$

   D. $\forall x Q(x) \wedge T$

   ANSWER: D

5. Symbolize the following expressions:

   All integers are rational numbers.

   Some integers are power of 2.

   Therefore some rational numbers are power of 2.

   A. $\forall x(I(x) \rightarrow R(x)), \exists x(I(x) \wedge P(x)) \Rightarrow \exists x(R(x) \wedge P(x))$

   B. $\forall x(I(x) \wedge R(x)), \exists x(I(x) \rightarrow P(x)) \Rightarrow \exists x(R(x) \wedge P(x))$

   C. $\forall x(I(x) \rightarrow R(x)), \exists x(I(x) \rightarrow P(x)) \Rightarrow \exists x(R(x) \wedge P(x))$

   D. $\forall x(I(x) \wedge R(x)), \exists x(I(x) \rightarrow P(x)) \Rightarrow \exists x(R(x) \rightarrow P(x))$

   ANSWER: A

6. Let $P(n) = n^2 - n + 41$ is a prime number then

   A. $P(3)$ is not true

   B. $P(5)$ is not true

   C. $P(41)$ is not true

   D. $P(1)$ is not true

   ANSWER: C

1. The number of vertices of odd degree in an undirected graph is ———

   A. odd

   B. even

   C. prime

   D. multiple of 3

   ANSWER: B

2. A graph in which there is exactly one edge between each pair of distinct vertices is called a ———

   A. complete graph

   B. wheel graph

   C. path graph

   D. complete bipartite graph

   ANSWER: A

3. For which of the following degree sequences the graph exists.

   A. 1, 1, 1, 1, 1

   B. 2, 2, 2, 1, 2

   C. 2, 2, 2, 2, 2

   D. 4, 4, 4, 3, 4

   ANSWER: C

4. The number of edges in a bipartite graph with n vertices is atmost ———-

   A. $\frac{n^2}{2}$

B. $\dfrac{n^2}{4}$

C. $\dfrac{n^2}{6}$

D. $\dfrac{n^2}{8}$

ANSWER: B

5. A connected graph contains an Euler circuit if and only if each of its vertices is of ——— degree.

   A. prime

   B. multiple of 4

   C. odd

   D. even

   ANSWER: D

6. A connected graph without any circuit is called a ————-

   A. tree

   B. subgraph

   C. eulerian graph

   D. hamiltonian graph

   ANSWER: A

7. An undirected graph is a tree if and only if there is a ——— simple path between every pair of vertices.

   A. no

   B. finite

   C. infinite

   D. unique

   ANSWER: D

8. A maximum number of edges in a simple disconnected graph G with n vertices and k components is

   A. $\dfrac{(n-k)(n-k+1)}{2}$

   B. $\dfrac{(n+k)(n-k+1)}{2}$

C. $\dfrac{(n-k)(n+k+1)}{2}$

D. $\dfrac{(n+k)(n+k+1)}{2}$

ANSWER: A

9. A connected graph contains an Euler path, if and only if it has exactly two vertices of ———

   A. even degree

   B. odd degree

   C. degree, multiple of 3

   D. degree, multiple of 5

   ANSWER: B

10. A tree with 50 vertices has ——— edges.

    A. 47

    B. 48

    C. 49

    D. 50

    ANSWER: C

11. If every internal vertex of a rooted tree has exactly two children, then the tree is called a ———

    A. full binary tree

    B. binary tree

    C. spanning tree

    D. full m ary tree

    ANSWER: A

12. The process of traversing T_1 first inorder and then visiting the root R and

containing the traversal of T_2 in inorder T_3 in inorder until T_n is traversal in inorder is called ———

A. preorder traversal

B. postorder traversal

C. inorder traversal

D. preorder and inorder traversal

ANSWER: C

13. Every vertex which is reachable from a vertex v is called ———— of v

A. leaf

B. root

C. children

D. descendent

ANSWER: D

14. A path of a graph G is called a ———— path if it includes each vertex of G exactly once.

A. hamiltonian

B. konisberg

C. eulerian

D. open

ANSWER: A

15. The number of edges in a complete graph with 8 vertices is

A. 25

B. 26

C. 27

D. 28

ANSWER: D

16. A circuit of a graph G is called ——— circuit, if it includes each edge of G exactly one.

A. an Eulerian

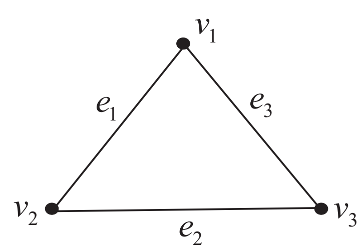
B. hamiltonian

C. strongly connected

D. weekly connected

ANSWER: A

17. The incidence matrix for the following graph is



A. $\begin{pmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \end{pmatrix}$

B. $\begin{pmatrix} 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \end{pmatrix}$

C. $\begin{pmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ 0 & 1 & 1 \end{pmatrix}$

D. $\begin{pmatrix} 1 & 1 & 0 \\ 1 & 1 & 0 \\ 1 & 1 & 0 \end{pmatrix}$

ANSWER: C

18. If V_1 contains 4 vertices and V_2 contains 3 vertices, then the number of edges in a complete bipartite graph is

A. 11

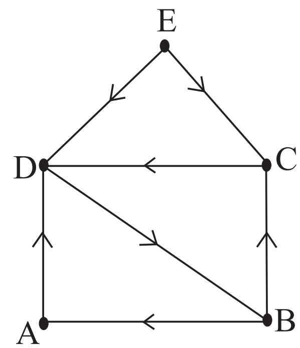
B. 12

C. 13

D. 14

ANSWER: B

1. The sum of the indegrees for the following graph is



A. 7

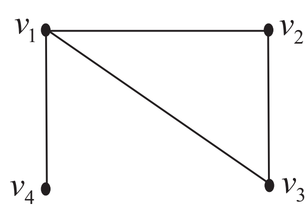
B. 8

C. 9

D. 10

ANSWER: A

2. The adjacency matrix for the following graph is



A. $\begin{pmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 1 & 0 & 0 & 0 \end{pmatrix}$

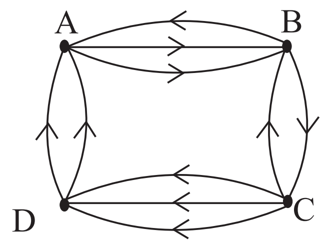
B. $\begin{pmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{pmatrix}$

C. $\begin{pmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 \end{pmatrix}$

D. $\begin{pmatrix} 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \end{pmatrix}$

ANSWER: B

3. The sum of the out degrees for the following graph is



A. 6

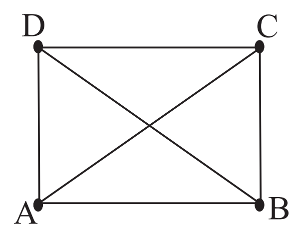
B. 8

C. 10

D. 12

ANSWER: C

4. The sum of the degrees of all the vertices for the following graph is



A. 6

B. 8

C. 10

D. 12

ANSWER: D

5. The minimum height of a 9-vertex binary tree is equal to ———- where $[x]$ denotes the smallest integer greater than or equal to x.

A. $[\log_2 10 + 2]$

B. $[\log_2 10 - 2]$

C. $[\log_2 10 + 1]$

D. $[\log_2 10 - 1]$

ANSWER: D

6. If a full binary tree contains 11 vertices then the number of pendent vertices of the tree is

   A. 5

   B. 6

   C. 7

   D. 8

   ANSWER: B

7. If every internal vertex of a rooted tree has atmost 2 children, then the tree is called a ———

   A. spanning tree

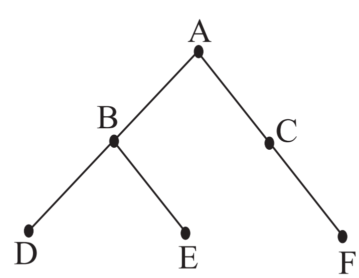
   B. binary tree

   C. full m - ary tree

   D. full binary tree

   ANSWER: B

8. The inorder traversal for the following binary tree is



   A. DEBCAF

   B. DEBACF

   C. DBEACF

   D. DBECFA

   ANSWER: C

9. The maximum height of the 11-vertex binary tree is

A. 5

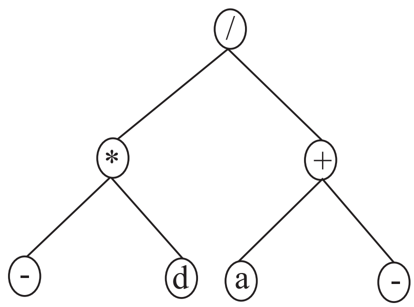
B. 6

C. 7

D. 8

ANSWER: A

10. The post fix form of the following graph is



A. $- * ad - +/$

B. $-d * a + -/$

C. $d - *a - +/$

D. $-d * a - +/$

ANSWER: D

11. The value of the post fix expression $825 - 13 - */$ is

A. $4/3$

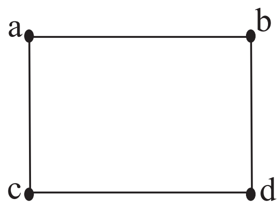
B. $5/3$

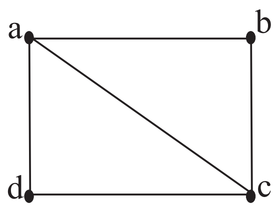
C. $7/3$

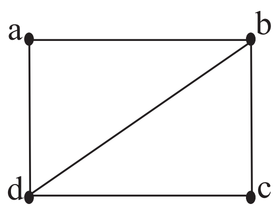
D. $8/3$

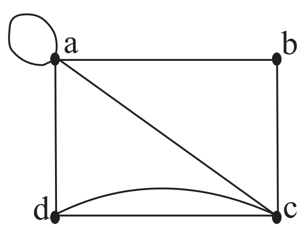
ANSWER: A

12. Which of the following graph is a pseudograph?

A. 

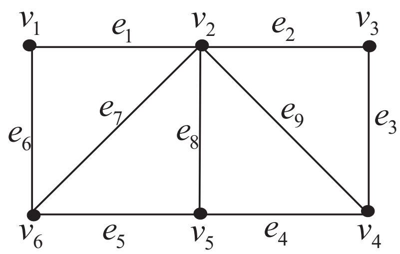
B. 

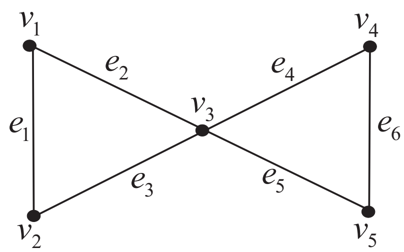
C. 

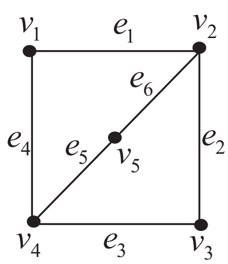
D. 

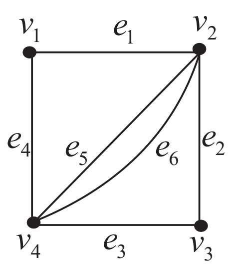
ANSWER: D

1. Which of the following graph is Hamiltonian but not Eulerian?

A. 

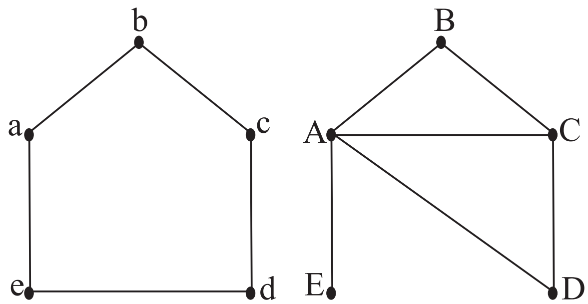
B. 

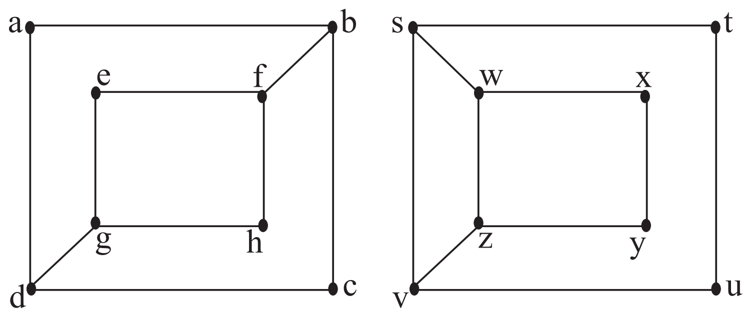
C. 

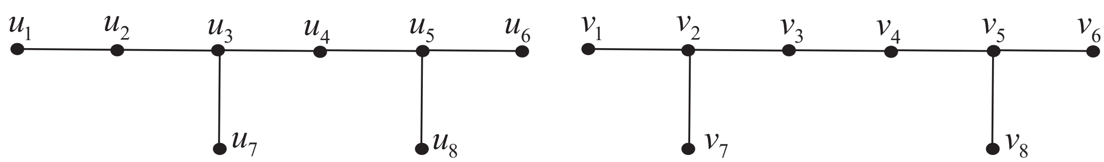
D. 

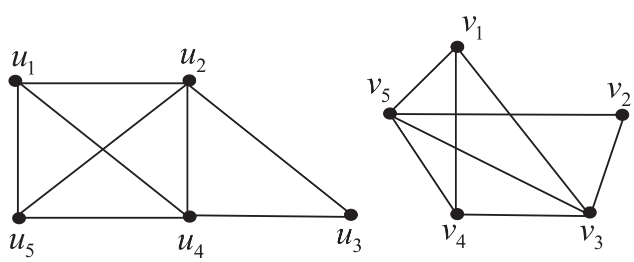
ANSWER: A

2. Which of the following graphs are isomorphic?

A. 

B. 

C. 

D. 

ANSWER: D

3. If all the vertices of an undirected graph are each of odd degree k, then the number of edges of the graph is a multiple of

   A. k

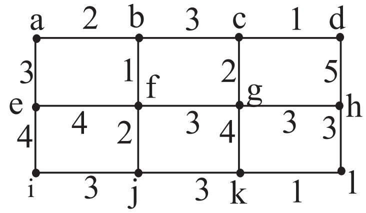
   B. k^2

   C. k^3

   D. k^4

   ANSWER: A

4. The total length of the minimum spanning tree for the following graph is



A. 20

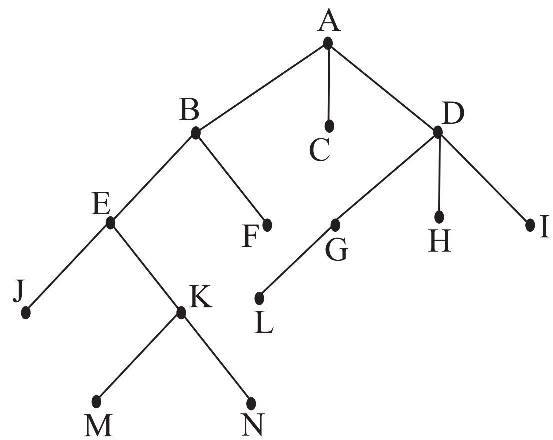
B. 24

C. 28

D. 32

ANSWER: B

5. The preorder traversal for the following graph is



A. ABEKMNJFCDGLHI

B. ABEJKMNGLHIFCD

C. ABEJKMNFCDGLHI

D. AEBJKMNCDGFLHI

ANSWER: C

6. The value of the prefix expression $+ - \uparrow 32 \uparrow 234$ is

A. 2

B. 3

C. 4

D. 5

ANSWER: D

N 18MAB 302 T DISCRETE MATHEMATICS

CYCLE TEST-3

Unit 4

1. Set of all 2x2 non - singular matrices with real entries under matrix multiplication
   (a) Doesn't form a group (b) forms an abelian group
   (c) Forms a finite group (d) forms an infinite non-abelian group

   Ans: (d)

2. Subgroup of the group of real numbers under addition $(R,+)$ is

   (a) (Z,+)
   (b) $(Z^{+},+)$
   (c) (Q,•)
   (d) $(R,-)$

Ans: (a)

2. In the cyclic group G={1,-1,i,-i} under multiplication it's generators are
   a) {1,i}
   b) {1,-i}
   c) {-1,i}
   d) {i,-i}

Ans: (d)

4.In a permutation group S_3, if $p=\begin{pmatrix} a & b & c \\ b & c & a \end{pmatrix}$, then inverse of p is

(a) $\begin{pmatrix} a & b & c \\ c & a & b \end{pmatrix}$

(b) $\begin{pmatrix} a & b & c \\ a & c & b \end{pmatrix}$

(c) $\begin{pmatrix} a & b & c \\ b & c & a \end{pmatrix}$

(d) $\begin{pmatrix} a & b & c \\ b & a & c \end{pmatrix}$

Ans: (a)

5.In a permutation group if $P_1 = \begin{pmatrix} a & b \\ a & b \end{pmatrix}$ $P_2 = \begin{pmatrix} a & b \\ b & a \end{pmatrix}$ then $P_2 * P_1$ =

a) P_1

b) P_2

c) P_1^{-1}

d) P_2^{-1}

Ans: b

6.If {G,*} is a finite cyclic group of order n with "a " as generator element, then ……….is also a generator iff the GCD of (m,n)=1 where m < n.

a) a^m
b) a^n
c) a^{m+n}
d) b^{-1}

Ans: a

7. The inverse of the element "a" in group (G,*) with binary operation a*b=a+b+2

(a) – a (b) a^{-1} (c) – 2 (d) – (a+4)

Ans: (d)

8.The order of the element –i in the group {1, -1,i,-i} under multiplication is

a) 1
b) 2
c) 3
d) 4

Ans: (d)

9.A cyclic group is ………………..

a) Subgroup

b) Abelian group

c) permutation group

d) Dihedral group

Ans: b

10. In a group, (G, *) for any a, b ε G, $(a*b)^{-1}$ = …………………..

a) $a^{-1} * b^{-1}$
b) $b^{-1} * a^{-1}$
c) a*b
d) b *a

ans b

11. If *is the binary operation on the set R of real numbers defined by a *b = a+b+2ab, then the identity element is

a) 0

b) 1

c) 1+2a

d) 2a

Ans:a

12. The kernel of a homomorphism f from a group (G,*) to another group (G′, Δ) is a ………….. of (G, *)

a) Empty subset of G
b) Subgroup of G
c) Abelian subgroup of G
d) Cyclic Subgroup of G

Ans: b

13.If a and b are any two elements of a group G such that $(a*b)^2 = a^2 * b^2$, then G is a …….

a) Cyclic group

b) Abelian Group

c) Permutation Group

d) Dihedral Group

Ans: b

14. The identity element of a group is the only element whose order is …

a) 1

b) 2

c) n

d) m + n

Ans: a

15.The multiplicative group $\{1, \omega, \omega^2\}$ where ω is a cube root of unity is a …….

a)Ring

b) Non-abelian group

c) Cyclic group

d) Monoid

Ans: c

16.A commutative ring with unity and without zero divisors is called an ……………….

a) Integral domain

b) zero divisor

c) Ring homomorphism

d) Field

Ans:a

17. Every finite integral domain is a …………….

a) cyclic group

b) Non-commutative Ring

c)Non abelian group

d) Field

Ans: d

18.The inverse operation of encoding is…………

a)Group code

b) Hamming code

c)) Decoding

d) Input message

Ans:c

19.The number of 1's in the binary string is called……………..

a) Distance

b) Group code

c)weight

d) Parity digit

Ans:c

20. A code can correct a set of atmost 'K' errors iff the minimum distance between any two code words is atleast ………..

a) 2k-1

b) k+1

c) k

d) 2k + 1

Ans:d

21. The number of errors can be corrected between the encoded words 000 and 111 is

a) Three errors

b) Two errors

c) Zero or one error

d) Four errors

Ans:c

22. If x = 10110 , y = 11110, then H(x,y) =

a)2

b) 1

c) 3

d) 4

Ans:b

23.The device which transforms the encoded message into their original form is.....

a) encoder

b) Decoder

c) Hamming Code

d) coding theory

Ans: b

24.If $(B^n, \oplus)$ is .... where $\oplus$ is addition modulo 2

a) Field

b) Cyclic group

c) Abelian group

d) Ring homomorphism.

Ans: c

25.Find the code words for e(111), e(110) generated by the parity check matrix:

$$H = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$ when the encoding function is e: $B^3 \rightarrow B^6$,

a) 000000,001010
b) 000110,100110
c) 110000,110100
d) 111001,110010
Ans :d

.

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF MATHEMATICS

Cycle Test 3

Subject Code: 18MAB302T
Subject: Discrete Mathematics for Engineers
Max. Mark:25

PART-A $(25 \times 1 = 25$ **Marks)**

Answer **all** questions

1. A graph in which loops and parallel edges are allowed is called a .....
   (A) weighted graph
   (B) simple graph
   (C) multigraph
   (D) pseudograph
   ANSWER:(D)

2. Which of the following statement for a graph is correct?
   (A) Simple path in a graph crosses the vertex any number of times.
   (B) A graph can exists without edges.
   (C) An edge in a graph is incident on more than two vertices.
   (D) Total degree of the vertices is odd.
   ANSWER:(B)

3. Let G be a simple connected graph such that every vertex in G has degree 4. If number of edges $(|E|) = 16$, then the number of vertices $(|V|)=$
   (A) 4
   (B) 8
   (C) 9
   (D) 16
   ANSWER: (B)

4. How many edges are there in a complete bipartite graph $K_{5,7}$?
   (A) 35
   (B) 12
   (C) 42
   (D) 49
   ANSWER: (A)

5. A graph is called a .... if it is connected and has no circuits.
(A) Cyclic graph
(B) Regular graph
(C) Tree
(D) Not graph
ANSWER: (C)

6. A .... circuit of G is a circuit which includes every edge of G exactly once?
(A) Euler
(B) Hamiltonian
(C) Planar
(D) Isomorphic
ANSWER: (A)

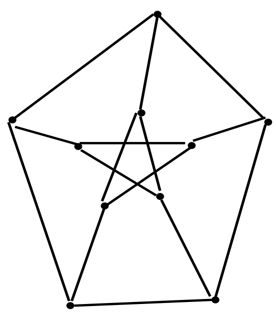
7. Chromatic number of a circuit of length 9 (C_9) is
(A) 9
(B) 5
(C) 2
(D) 3
ANSWER: (D)

8. Which of the following statement is false?
(A) Total degree of a tree with n vertices is $2n-2$
(B) There is no circuit in a tree
(C) There exists a tree with 8 vertices and 8 edges
(D) A tree with e edges has $e+1$ vertices
ANSWER: (C)

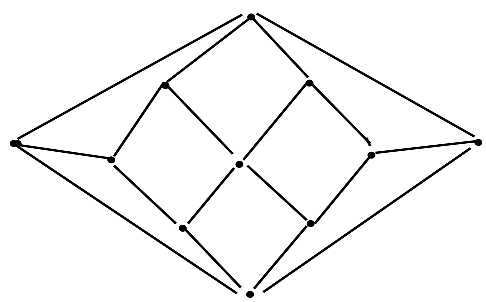
9. The maximum number of edges in a simple disconnected graph with n vertices and k components is
(A) $\dfrac{(n+k)(n+k+1)}{2}$
(B) $\dfrac{(n+k)(n-k+1)}{2}$
(C) $\dfrac{(n-k)(n-k+1)}{2}$
(D) $\dfrac{(n-k)(n+k+1)}{2}$
ANSWER: (C)

10. Which of the following completely bipartite graph is a complete graph?
 (A) $K_{7,5}$
 (B) $K_{1,1}$
 (C) $K_{n,n}$
 (D) $K_{m,n}$
 Answer: (B)

11. Which of the following is true for the graph A and graph B of 10 and 11 vertices respectively?



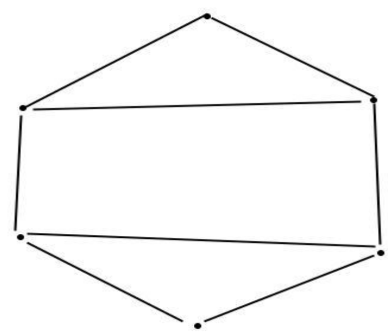
Graph A



Graph B

 (A) Both graphs A and B contain a Hamiltonian circuit
 (B) Neither graph A nor B contains a Hamiltonian circuit
 (C) Graph A contains a Hamiltonian circuit
 (D) Graph B contains a Hamiltonian circuit
 ANSWER: (B)

12. Which of the following is true for the following graph G with 6 vertices?



Graph G

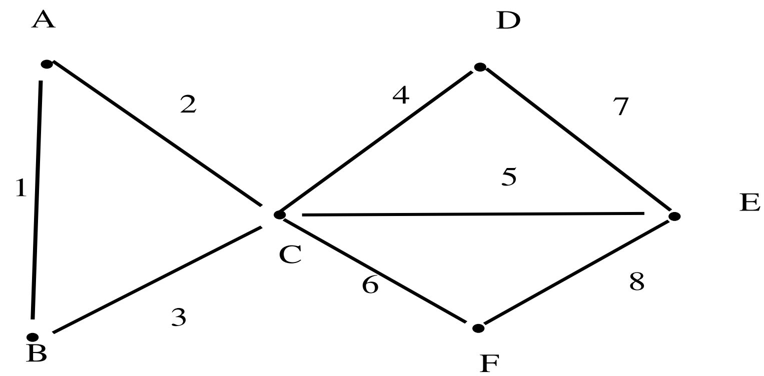
(A) G is Hamiltonian but not Eulerian
(B) G is both Eulerian and Hamiltonian
(C) G is neither Eulerian and Hamiltonian
(D) G is Eulerian but not Hamiltonian
ANSWER: (A)

13. A vertex which is adjacent to exactly one vertex is called
(A) Isolated Vertex
(B) Pendant Vertex
(C) Incident Vertex
(D) Simple Vertex
ANSWER: (B)

14. Every complete graph is
(A) Completely bipartite
(B) Tree
(C) Regular
(D) Bipartite
ANSWER: (C)

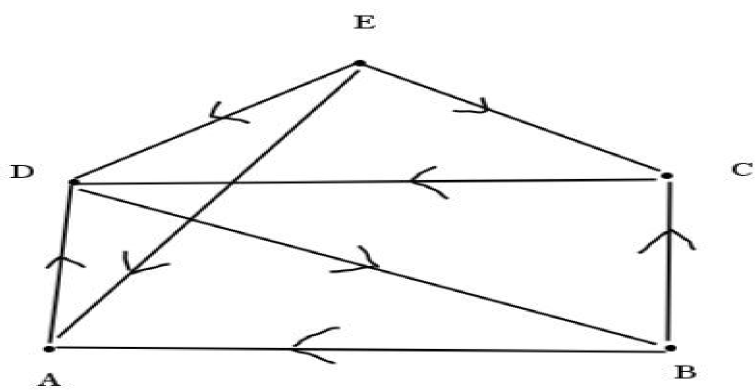
15. The number of edges of a complete graph K_{10} is
(A) 10
(B) 25
(C) 20
(D) 45
ANSWER: (D)

16. Find the total minimum weight for the following weighted graph using Kruskal's Algorithm



(A) 18
(B) 15
(C) 12
(D) 20
ANSWER: (A)

17. The sum of the indegree vertices for the following directed graph is



(A) 8
(B) 9
(C) 10
(D) 11
ANSWER: (A)

18. The adjacency matrix corresponding to a complete graph of 4 vertices (K_4)is
(A) $\begin{pmatrix} 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 \end{pmatrix}$ (B) $\begin{pmatrix} 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 \end{pmatrix}$ (C) $\begin{pmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{pmatrix}$ (D) $\begin{pmatrix} 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 1 \end{pmatrix}$
ANSWER: (C)

19. What is the chromatic number of the complete bipartite graph $K_{m,n}$?
(A) 2
(B) 3
(C) 6
(D) 5
ANSWER: (A)

20. A row with all 0 (zero) entries in the incidence matrix corresponds to ....
(A) pendant vertex
(B) an isolated vertex
(C) a vertex of degree 2
(D) a vertex of degree 3
ANSWER: (B)

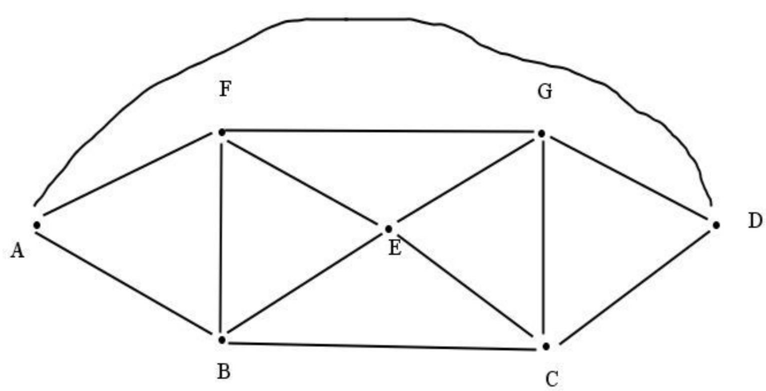
21. If there is a unique path between every pair of vertices then the graph is
(A) Connected circuitless graph
(B) Disconnected graph
(C) Connected Cyclic graph
(D) Complete graph
ANSWER: (A)

22. Length of the path of a graph is the
(A) Number of vertices in the graph
(B) Number of edges in the path
(C) Number of vertices in the path
(D) Number of edges in the graph
ANSWER: (B)

23. If the origin and terminal vertex of the path are same then the path is called
(A) Euler path
(B) Tree
(C) Circuit
(D) Hamiltonian path
ANSWER: (C)

24. Which of the following graph is 4-Chromatic?
(A) Complete bipartite graph of 3,3 vertices ($K_{3,3}$)
(B) Complete graph of 5 vertices (K_5)
(C) Complete graph of 4 vertices (K_4)
(D) Complete bipartite graph of 4,4 vertices ($K_{4,4}$)
ANSWER: (C)

25. What is the chromatic number of the following graph with 7 vertices?



(A) 3
(B) 4
(C) 1
(D) 2
ANSWER: (B)

Faculty of Engineering and Technology	**For the students admitted batches** **UG & PG (Full Time)** B.Tech. - 2015 to 2019 batches B.Arch - 2015 to 2019 batches B.Des. – 2015 to 2019 batches M.Tech. - 2013 to 2019 batches M.Arch - 2019 batch **UG & PG Part Time** B.Tech - 2017 to 2019 batches M.Tech. – 2015 to 2019 batches	**PATTERN - I** **(Problem / Analytics / Programming Intensive Courses)** **PART – A** (30 X 1 = 30 Marks) MCQs (Remember and Understand) **PART – B** (15 X 2 = 30 Marks) Descriptive Type (Apply and Analysis) **(Typing / scan & upload - work sheet)** **PART - C** (5 X 3 = 15 Marks) Descriptive type **(Typing / Scan & upload)**	50	75	**100 Minutes**