SRINIVAS UNIVERSITY
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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

QUESTION BANK

DISCRTE MATHEMATICAL STRUCTURES AND GRAPH THEORY

SUBJECT CODE: 19SCS41/19SAV41

COMPILED BY:

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MODULE 1

FUNDAMENTALS OF LOGIC

1. Which of the following proposition is tautology?

A) $(p \vee q) \rightarrow q$ B) $p \vee (q \rightarrow p)$ C) $p \vee (p \rightarrow q)$ D) Both B and C

2. The proposition $p \wedge (\neg p \vee q)$ is

A) Tautology B) contradiction C) logically equivalent $(p \wedge q)$ D) All

3. Which of the following stamen 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 even or -3 is not negative D) 2 is odd and -3 is not negative

4. $p \rightarrow q$ is logically equivalent to

A) $\neg q \rightarrow p$ B) $\neg p \rightarrow q$ C) $\neg p \wedge q$ D) $\neg p \vee q$

5. $\neg (p \rightarrow q)$ is equivalent to

A) $p \wedge \neg q$ B) $p \wedge q$ C) $\neg p \vee q$ D) None of these

6. In proportional logic, which of the following is equivalent to $p \rightarrow q$

A) $\neg p \rightarrow q$ B) $\neg p \vee q$ C) $\neg p \vee \neg q$ D) $p \rightarrow q$

7. Let $p, q, r,$ be true, false, false respectively which of the following is true

A) $p \wedge (q \wedge \neg r)$ B) $(p \rightarrow q) \wedge \neg r$ C) $q \leftrightarrow (p \wedge r)$ D) $p \leftrightarrow (q \vee r)$

8. Negation of the statement $(A \wedge B) \rightarrow (B \vee C)$

A) $(A \wedge B) \rightarrow (\neg B \vee \neg C)$ B) $\neg (A \wedge B) \vee (B \vee C)$ C) $\neg (A \rightarrow B) \rightarrow (\neg B \vee C)$ D) None

9. The contra positive of $p \rightarrow q$ is

A) $\neg p \rightarrow \neg q$ B) $\neg q \rightarrow \neg p$ C) $q \rightarrow p$ D) $\neg q \rightarrow p$

10. The inverse of $p \rightarrow q$ is

A) $\neg p \rightarrow \neg q$ B) $\neg q \rightarrow \neg p$ C) $q \rightarrow p$ D) $\neg q \rightarrow p$

11. The converse of $p \rightarrow q$ is

A) $\neg p \rightarrow \neg q$ B) $\neg q \rightarrow \neg p$ C) $q \rightarrow p$ D) $\neg q \rightarrow p$

12. $p \wedge q$ is logically equivalent to

A) $\neg q \rightarrow \neg p$ B) $q \rightarrow p$ C) $\neg p \rightarrow \neg q$ D) $\neg p \rightarrow q$

13. Which rule of inference is used in each of these arguments" If it is Wednesday, then shop will be crowded." "It is Wednesday, and then the shop is crowded".

A) Modes tollens B) Modes Ponens C) Disjunctive syllogism D) Simplification

14. The premise $(p \wedge q) \vee r \wedge r \rightarrow s$ implies which of the conclusion?

A) $p \vee r$ B) $p \vee s$ C) $q \vee s$ D) $q \vee r$

15. What rules of inference are used in this argument?
"It is either colder than Himalaya today or the pollution is harmful. It is hotter than Himalaya today. Therefore, the pollution is harmful."
A) Conjunction B) Modus ponens C) Disjunctive syllogism D) None of these

16. Negation of a quantified statement $\forall x : p(x)$
A) $\forall x : \neg p(x)$ B) $\exists x : p(x)$ C) $\exists x : \neg p(x)$ D) None of these

17. The logical translation of the statement "None of my friends are perfect"

A) $\exists x[A(x) \wedge \neg B(x)]$ B) $\exists x[\neg A(x) \wedge B(x)]$

C) $\exists x[\neg A(x) \wedge \neg B(x)]$ D) $\neg \exists x[A(x) \wedge B(x)]$

18. Which of them are equivalent? 1. $\neg \forall x P(x)$ 2. $\neg \exists x P(x)$ 3. $\neg \exists x \neg P(x)$ 4. $\exists x \neg P(x)$

A) 1 and 3 B) 2 and 3 C) 1 and 4 D) 2 and 4

19. $p \rightarrow (q \rightarrow r)$ is equivalent to

A) $(p \wedge q) \rightarrow r$ B) $(p \vee q) \rightarrow r$ C) $(p \vee q) \rightarrow \neg r$ D) none of these

20. The NAND statement is combination of

A) NOT and AND B) NOT and OR C) AND and OR D) AND or OR

21. The NOR statement is combination of

A) NOT and AND B) NOT and OR C) AND and OR D) AND or OR

22. The negation of "Today is Monday" is:
A. Today is Saturday B. Today is Wednesday
C. Today is Monday D. Today is not Monday

23. An argument is ______ if the conclusion is not true when all the premises are true:
A. invalid B. False C. valid D. None of the above

24. Which of the following is/are tautology?

A. $a \vee b \rightarrow b \wedge c$ B. $a \wedge b \rightarrow b \vee c$ C. $a \vee b \rightarrow (b \rightarrow c)$ D. None of these

Descriptive questions

1. Prove that $(p \vee q) \wedge \neg ¿ \vee (\neg p \wedge \neg q) \vee (\neg p \wedge \neg r)$ ¿ is a tautology

2. Prove the logical equivalence without using truth table
$(q \wedge r) \vee (p \wedge r) \Leftrightarrow r$
$[\neg p \wedge (\neg q \wedge r)] \vee ¿$

3. Write Converse, Inverse, Contra positive and Negation of "If a triangle is not isosceles then it is not equilateral"

4. Establish the validity of (a) and by contradiction method of (b)

(a)
$$\begin{array}{l} p \rightarrow q \\ q \rightarrow (r \wedge s) \\ \neg r \vee (\neg t \vee u) \\ p \wedge t \\ \hline \therefore u \end{array}$$

(b)
$$\begin{array}{l} p \rightarrow q \\ \neg r \vee s \\ p \vee r \\ \hline \therefore \neg q \rightarrow s \end{array}$$

5. Show that the hypothesis "If I study, I will not fail in the exam. If I do not watch TV in the evening I will study. I failed in the exam. Therefore I must have watched TV in the evening."

6. Test the validity, No engineering student of 1st or 2nd semester studies logic

Anil is an engineering student who studies logic

$\therefore$ Anil is not in 2nd semester.

7. Test the validity ,Since every square is a rectangle and every rectangle is parallelogram, it follows that every square is a parallelogram.

8. Test the validity, "If band could not play rock music or the refreshment were not delivered on time, then the new year party would have been cancelled and Anitha would have been angry. If the party were cancelled, the refunds would have be made. No refunds were made. Therefore the band could play rock music.

9. Construct the truth table $[(p \vee q) \rightarrow r] \leftrightarrow [\neg r \rightarrow \neg(p \vee q)]$

MODULE 2

PROPERTIES OF THE INTEGERS

1. What is the base case for the inequality $7^n > n^3$, where n = 3?
   A) 652 > 189 B) 42 < 132 C) 343 > 27 D) 42 <= 431

2. For m = 1, 2, ………, 4m+2 is a multiple of ________
   A) 3 B) 5 C) 6 D) 2

3. For any integer $m \geq 3$, the series $2+4+6+\ldots+(4m)$ can be equivalent to ________
   A) m^2+3 B) $m+1$ C) m^m D) $3m^2+4$

4. By induction hypothesis, the series $1^2 + 2^2 + 3^2 + \ldots + p^2$ can be proved equivalent to ________
   A) p^2+27 B) $\frac{p(p+1)(2p+1)}{6}$ C) $\frac{p(p+1)}{4}$ D) $p+p^2$

5. For any positive integer m, ______ is divisible by 4.
   A) $5m^2+2$ B) $3m+1$ C) m^2+3 D) m^3+3m

6. How many even 4 digit whole numbers are there?
   A) 1358 B) 7250 C) 4500 D) 3600

7. In a multiple-choice question paper of 15 questions, the answers can be A, B, C or D. The number of different ways of answering the question paper are ________
   A) 65536 x 4^7 B) 194536 x 4^5 C) 23650 x 4^9 D) 11287435

8. How many five-digit numbers can be made from the digits 1 to 7 if repetition is allowed?
   A) 16807 B) 54629 C) 23467 D) 32354

9. How many words that can be formed with the letters of the word 'SWIMMING' such that the
vowels do not come together?
A) 430 B) 623 C) 729 D) 1239

10. In how many ways can 10 boys be seated in a row having 28 seats such that no two friends
occupy adjacent seats?
A) ${}^{13}P_5$ B) ${}^{9}P_{29}$ C) ${}^{19}P_{10}$ D) ${}^{15}P_7$

11. In how many ways can the letters of the word SANFOUNDRY be rearranged such that the
vowels always appear together?
A) $(8+3)!2!$ B) $6!2!$ C) $8!3!$
D) 4!8!

12. How many numbers of three digits can be formed with digits 1, 3, 5, 7 and 9?
A) 983 B) 120 C) 345 D) 5430

13. How many words can be formed with the letters of the word 'CASTLE' when 'C' and 'E' occupying end places.
A) 217 B) 48 C) 75 D) 186

14. Find the number of ways in which 4 people E, F, G, H, A, C can be seated at a round table,
such that E and F must always sit together.
A) 32 B) 290 C) 124 D) 48

15. For all $n \in N, 3.5^{2n+1} + 2^{3n+1}$ is divisible by
A) 19 B) 17 C) 21 D) 25

16. If $10^n + 3.4^{n+2} + k$ is divisible by 9 for all $n \in N$ then the least positive integral value of k

A) 5 B) 3 C) 7 D) 1

17. How many different words can be formed out of the letters of the word VARANASI?

A) 64 B) 120 C) 40320 D) 720

18. In how many ways can a president and vice president be chosen from a set of 30 candidates?
A) 820 B) 850 C) 880 D) 870

19. The number of distinguishable permutations of the letters in the word BANANA are,

A) 60 B) 36 C) 20 D) 10

20. A student has a maximum of 720 words from a combination of letters of word given word is:

A. CANADA B. ENGLAND C. WASHINGTON D. None the above

21. Letters of CHORD taken all at a time can be written in:

A. 500 B. 120 C. 122 D. 135

22. If P(n) is the statement $n \epsilon N$ such that if $P(k)$ is true, $P(k+1)$ is true of $k \epsilon N$, then P(n) is true

A. for all $n>1$ B. for all $n>2$ C. for all n D. none of these

23. Find the middle terms of $\left(2x+\frac{1}{x}\right)^8$

A. $8_{C_4} X 2^4$ B. $8_{C_4} X 2^5$ C. 8_{C_4} D. none of these

Descriptive questions

1. Prove the following by mathematical induction

(a) $\frac{1}{2.5}+\frac{1}{5.8}+\frac{1}{8.11}+.............+\frac{1}{(3n-1)(3n+2)}=\frac{n}{6n+4}$ for all positive integers , $n\geq1$

(b) $1.3+2.4+3.5+...........+n(n+2)=\frac{n(n+1)(2n+7)}{6}, n\geq1$

(c) For any positive integer $11^{n+2}+12^{2n+1}$ is divided by 133

(d) Let $H_1=1, H_2=1+\frac{1}{2}, H_3=1+\frac{1}{2}+\frac{1}{3},..........,H_n=1+\frac{1}{2}+\frac{1}{3}+........+\frac{1}{n}$

Prove that $\sum_{i=1}^{n} H_i=(n+1)H_n-n$ for all positive integers , $n\geq1$.

2. For the Fibonacci sequence $F_0, F_1, F_2....$ prove that $F_n=\frac{1}{\sqrt{5}}[\left(\frac{1+\sqrt{5}}{2}\right)^n-\left(\frac{1-\sqrt{5}}{2}\right)^n]$

3. If $L_0, L_1, L_2.....$ are Lucus numbers then P.T $L_{n+4}-L_n=5F_{n+2}$

4. How many arrangements are there for all letters in the word SOCIOLOGICAL? In how many of these arrangements (i) A and G are adjacent (ii) all the vowels are adjacent.

5. A women has 11close relatives and she wishes to invite 5 of them to dinner. In how many ways she can invite them in the following situations i) There is no restriction on the choice ii) Two particular persons will not attend separately. iii) Two particular persons will not attend together.

6. Determine the coefficient of (a) x^0 in the expansion of $\left(3x^2-\frac{2}{x}\right)^{15}$

(b) $a^2b^3c^2d^5$ in the expansion of $(a+2b-3c+2d+5)^{16}$

7. In how many way can one distribute 8 identical balls into 4 distinct containers so that (i) no

containers is left empty (ii) the 4^{th} container gets an odd number of balls.

MODULE 3

RELATIONS AND FUNCTIONS

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

A) equivalence relation B) reflexive relation C) symmetric relation D) transitive relation

2. Determine the number of possible relations in an antisymmetric set with 19 elements.

A) 23585 B) $2.02 * 10^{87}$ C) $9.34 * 7^{91}$ D) 35893

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

A) symmetric only B) anti-symmetric only

C) an equivalence relation D) both symmetric and anti-symmetric

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

A) 6 B) 5 C) 9 D) 4

5. If A and B are two sets containing respectively m and n distinct elements. How many different

relations can be defined for A and B?

A) $2m-n$ B) $2\frac{m}{n}$ C) $2mn$

D) $2m+n$

6. What is the possible number of reflexive relations on a set of 5 elements?

A) 2^{10} B) 2^{15} C) 2^{20}

D) 2^{25}

(Ans : 2^{n^2-n} which is 2^{20} for $n=5$)

7. Let A = {1, 2, 3}. The total number of distinct relations that can be defined over *A* is

A) 2^9 B) 6 C) 8 D) None of these

8. How many onto functions are there from an n-element $n \geq 2$ set to a 2-element set?

A) 2^n B) 2^n-1 C) 2^n-2 D) $2(2^n-2)$

9. ______ number of reflexive closure exists in a relation R = {(0,1), (1,1), (1,3), (2,1), (2,2), (3,0)} where {0, 1, 2, 3} ∈ A.

A) 2^6 B) 6 C) 8 D) 36

10. If R is a relation on a finite set having a elements , then the number of relations on A is

A) a^2 B) a^a C) 2a D) $2a^2$

11. There are only five distinct Hasse diagrams for partially ordered set that contain

A) 2 B) 3 C) 4 D) 6

12. A function is said to be ______________ if and only if f(a) = f(b) implies that a = b for all a and b in the domain of f.

A) One-to-many B) One-to-one C) Many-to-many D) Many-to-one

13. Let f and g be the function from the set of integers to itself, defined by $f(x)=2x+1$ and $g(x)=3x+4.$ Then the composition of f and g is ____________

A) $6x+9$ B) $6x+7$ C) $6x+6$ D) $6x+8$

14. The inverse of function $f(x)=x^3+2$ is ____________

A) $f^{-1}(y)=(y-2)^{\frac{1}{2}}$ B) $f^{-1}(y)=(y-2)^{\frac{1}{3}}$ C) $f^{-1}(y)=(y)^{\frac{1}{3}}$ D) $f^{-1}(y)=(y-2)$

15. The universal relation A x A on A is

A) anti-symmetric B) an equivalence relation C) a partial ordering relation D) none

16. Let n(A) denotes the number of elements in set A. If n(A) =p and n(B) = q, then how many ordered pairs (a, b) are there with a ∈ A and b ∈ B ?

A) pxq B) $p+q$ C) $2pq$ D) $4pq$

17. If $f(x)=\tan(x),$ then $f^{-1}\left(\frac{1}{\sqrt{3}}\right)=¿$

A) $\frac{\pi}{6}$ B) $\frac{\pi}{4}$ C) $\frac{\pi}{3}$ D) π

18. If $f(x)=-2x+8,$ then $f^{-1}(1)=¿$

A) 9⁄2 B) 7⁄2 C) 2⁄9 D) 0

19. If $f(x)=\tan^{-1}x$ and $g(x)=\tan(x),$ then $(gof)(x)=¿$

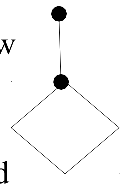
A) $\tan^{-1}x\tan(x)$ B) $\tan^{-1}x\cot(x)$ C) x D) $\tan^{-1}x\sin(x)$

20. 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

21. 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) 4

Descriptive questions

1. Let A & B be finite sets $|B|=3$ If there are 4096 relations from A to B what is $|A|$?
2. Let f and g be function from R to R defined by $f(x)=ax+b$ and $g(x)=1-x+x^2$. If $gof(x)=9x^2-9x+3$, determine a and b.
3. Let $A=\{1,2,3,4\}, B=\{1,2,3,4,5,6\}$ (a) How many function are there from A to B., How many of these are one-one, How many of these are onto. (b) How many function are there from B to A., How many of these are one-one, How many of these are onto (c) How many bijective function from A to B.
4. State the pigeon hole principle and P.T in any set of 29 persons at least 5 persons must have
been born on the same day of the weak.
5. Let $A=\{1,2,3,4,6,12\}$. On A, define the relation R by aRb if and only if a divides b. Prove
that R is a partial order on A. Draw the Hasse diagram for this relation.
6. For $A=\{a,b,c,d,e\}$, the Hasse diagram for the poset (A,R) is shown below
(a) Determine the relation matrix for R
(b) Construct digraph for R.



7. Let f,g,h be a function from z to z defined by $f(x)=x-1, g(x)=3x$ and
$h(x)=\begin{cases}0 \text{ if } x \text{ is even}\\ 1 \text{ if } x \text{ is odd}\end{cases}$. Determine $[fo(goh)](x)$ and $[(fog)oh](x)$
8. P.T if $f:A\to B, g:B\to C$ are the invertible function then $gof:A\to C$ is invertible and $(gof)^{-1}=f^{-1}o\,g^{-1}$.
9. Draw the Hasse diagram representing the positive devisors of 36 and 72.
10. Find the number of ways of distributing four distinct objects among 3 identical containers with some containers is empty.

MODULE 4

THE PRINCIPLE OF INCLUSION AND EXCLUSION

1. The numbers between 1 and 520, including both, are divisible by 2 or 6 is ________

A) 349 B) 54 C) 213 D) 303

2. In class, students want to join sports. 15 people will join football, 24 people will join basketball, and 9 people will join both. How many people are there in the class?

A) 19 B) 82 C) 64 D) 30

3. The sum of all integers from 1 to 520 that are multiples of 4 or 5?

A) 187 B) 208 C) 421 D) 52

4. Determine the value of a2 for the recurrence relation $a_n = 17a_{n-1} + 30n$ with $a_0=3$.

A) 4387 B) 5484 C) 238 D) 1437

5. Which one of the following problem types does inclusion-exclusion principle belong to?

A) Numerical problems B) Graph problems

C) String processing problems D) Combinatorial problems

6. Which of the following is a correct representation of inclusion-exclusion principle?

A) ¿ $A\ U\ B$ ∨¿∨ A ∨+¿ B ∨−¿ $A \cap B$ ∨¿ B) ¿ $A \cap B$ ∨¿∨ A ∨+¿ B ∨−¿ $A\ U\ B$ ∨¿

C) ¿ $A\ U\ B$ ∨¿∨ A ∨+¿ B ∨+¿ $A \cap B$ ∨¿ D) ¿ $A \cap B$ ∨¿∨ A ∨+¿ B ∨+¿ $A\ U\ B$ ∨¿

7. Calculate the number of multiples of 3 or 5 from 1 to 500.

A) 233 B) 166 C) 275 D) 100

8. What is the cardinality of set of odd positive integers less than 10?

A) 5 B) 10 C)3 D) 20

9. Let $A=\{1,2,3\}B=\{2,3,4\}C=\{1,3,5\}D=\{2,3\}$. Find the cardinality of sum of all the sets.

A) 6 B) 5 C) 4 D) 7

10. How many integers from 1 to 100 are multiples of 2 or 3?

A) 46 B) 63 C) 67 D) 49

11. Number of permutations of n distinct elements taking n elements at a time

A) n_{C_2} B) $n_{C_{n-1}}$ C) $n!$ D) None of these

12. The rook polynomial of $1x1$ board

A) $x+1$ B) $2x+3$ C) $3x+1$ D) x

13. The term a_4 of the sequence 2,10,50,250,………. is

A) 1250 B) 500 C) 2500 D) 1500

14. If k_1 and k_2 are real and distinct roots of second order linear homogenous recurrence relation

then auxiliary equation is

A) $A k_1^n + B k_2^n$ B) $(A+Bn) k_1^n k_2^n$ C) $r^n (A cosn\theta + B sinn\theta)$ D) None of these

15. If k_1 and k_2 are real and equal roots of second order linear homogenous recurrence relation

then auxiliary equation is

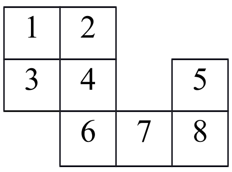
A) $A k_1^n + B k_2^n$ B) $(A+Bn)k^n$ C) $r^n(A cosn\theta + B sinn\theta)$ D) None of these

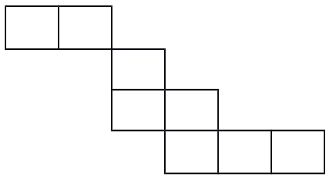
16. If k_1 and k_2 are complex roots of second order linear homogenous recurrence relation then auxiliary equation is

A) $A k_1^n + B k_2^n$ B) $(A+Bn)k^n$ C) $r^n(A cosn\theta + B sinn\theta)$ D) None of these

Descriptive questions

1. Determine the number of positive integers n such that $1 \leq n \leq 100$ and n is not divisible by 2,3,or 5.
2. In how many ways 5 number of a's, 4 number of b's and 3 number of c's can be arranged so that all the identical letters are not in a single block.
3. In how many ways can one arrange the letters in the word CORRESPONDENTS so that
   (i) there is no pair of consecutive identical letters?
   (ii) there are exactly 2 pairs of consecutive identical letters?
   (iii) there are at least 3 pairs of consecutive identical letters?
4. Define derangement . There are eight letters to eight different people to be placed in eight different addressed envelopes. Find the number of ways of doing this so that at least one letter gets to the right person.
5. Find the rook polynomial for the following board





6. An apple, a banana, a mango, and an orange are to be distributed to four boys B_1, B_2, B_3, B_4. The boys B_1 and B_2 do not wish to have apple, the boy B_3 does not want banana or mango, and B_4 refuses orange. In how many ways the distribution can be made so that no boy is displeased.
7. Five teachers T_1, T_2, T_3, T_4, T_5 are to be made class teachers for five classes C_1, C_2, C_3, C_4, C_5 one teacher for each class. $T_1 \wedge T_2$ do not wish to become class teacher for $C_1 \vee C_2$, $T_3 \wedge T_4$ for $C_4 \wedge C_5$ and T_5 for $C_3 \vee C_4 \vee C_5$. In how many ways can the teacher be assigned to work.

8. Solve the recurrence relation of
   (a) $a_n + a_{n-1} - 6a_{n-2} = 0, n \geq 2$ given $a_0 = -1 \wedge a_1 = 8$

(b) $a_n - 6a_{n-1} + 9a_{n-2} = 0, n \geq 2$ given $a_0 = 5, a_1 = 12$

(c) $a_{n+2} + 3a_{n+1} + 2a_n = 3^n, n \geq 2,$ given $a_0 = 0, a_1 = 1$

MODULE 5

Introduction to Graph Theory

1. In a tree between every pair of vertices there is
   A) Exactly one path B) A self loop C) two circuits D) n number of paths
2. A graph G is called a ..... if it is a connected acyclic graph
   A) Cyclic graph B) Regular graph C) Tree D) Not a graph
3. A graph is a collection of
   A) Row and columns B) Vertices and edges C) Equations D) none of these
4. A vertex of a graph is called even or odd depending upon
   A) Total number of edges in a graph is even or odd B) Its degree is even or odd
   C) Total number of vertices in a graph is even or odd D) None of these
5. In any undirected graph the sum of degrees of all the nodes
   A) Must be even B) Are twice the number of edges
   C) Must be odd D) Need not be even
6. A graph with one vertex and no edges is
   A) multigraph B) digraph C) isolated graph D) trivial graph
7. Length of the walk of a graph is
   A) The number of vertices in walk W B) The number of edges in walk W
   C) Total number of edges in a graph D) Total number of vertices in a graph
8. A graph with no edges is known as empty graph. Empty graph is also known as
   A) Trivial graph B) Regular graph C) Bipartite graph D) None of these
9. The maximum degree of any vertex in a simple graph with n vertices is
   A) $n-1$ B) $n+1$ C) $2n-1$ D) n .
10. The complete graph with four vertices has k edges where k is
    A) 3 B) 4 C) 5 D) 6
11. Suppose v is an isolated vertex in a graph, then the degree of v is
    A) 0 B) 1 C) 2 D) 3
12. Circle has _____________
    A) No vertices B) Only 1 vertex C) 8 vertices D) None of these
13. A graph is tree only if
    A) Is planar B) Contains a circuit C) Is minimally D) Is completely connected
14. A graph G is called a ..... if it is a connected acyclic graph ?
    A) Cyclic graph B) Regular graph C) Tree D) Not a graph

15. If the origin and terminus of a walk are same, the walk is known as... ?
A) Open B) Closed C) Path D) None of these
16. A tree having a main node, which has no predecessor is.... ?
A) Spanning tree B) Rooted tree C) Weighted tree D) None of these
17. Which of the following statements for a simple graph is correct?
A) Every path is a trail B) Every trail is a path
C) Every trail is a path as well as every path is a trail D) Path and trail have no relation
18. How many edges are there in complete graph of order 9?
A) 35 B) 36 C) 45 D) 19
19. ………. is the maximum number of edges in an acyclic undirected graph with k vertices
A) $k-1$ B) k^2 C) $2k+3$ D) k^3+4
20. In a …………… the degree of each and every vertex is equal
A) Regular graph B) Multi graph C) Euler graph D) Star graph
21. All closed walk are of …………..length in a bipartite graph
A) infinite B) odd C) even D) finite
22. In a m-ary tree, each vertex has at most ………. children
A) n B) n^4 C) $n-1$ D) $\frac{n(n-1)}{2}$
23. The …………… of a graph G consists of all vertices and edges of G
A) Parallel graph B) Line graph C) Component D) Eulerian circuit
24. A trail in a graph can be described as
A) a walk without repeated edges B) a cycle without repeated edges
C) a walk with repeated edges D) a line graph with one or more vertices
25. The vertex which is of 0 degree is called?
A. Leaf B. Root C. Internal node D. None of the above
26. What is true about star tree?
A. A tree having n vertices arranged in a line
B. A tree which contains n vertices and n-1 cycles
C. A tree having a single internal vertex and n-1 leaves
D. A tree which has 0 or more connected subtrees

27. A graph which consists of disjoint union of trees is called ______
A) bipartite graph B) forest C) caterpillar tree D) labeled tree
28. In preorder traversal of a binary tree the second step is _____________
A) traverse the right subtree B) traverse the left subtree
C) traverse right subtree and visit the root D) visit the root

29. Every node N in a binary tree T except the root has a unique parent called the ……… of N.
A. Antecedents B. Predecessor C. Forerunner D. Precursor

30. A terminal node in a binary tree is called …………
A. Root B. Leaf C. Child D. Branch

Descriptive questions

1. Give the pictorial and graph representation of Konigsberg bridge problem and state the problem

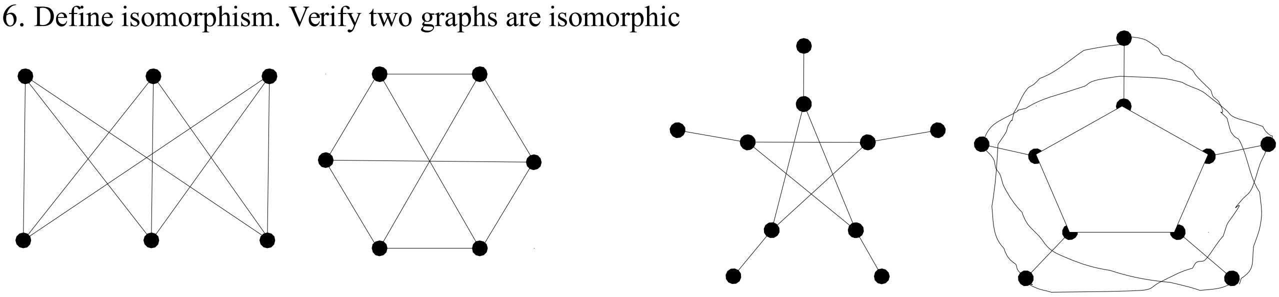
2. Define tree. Suppose that a tree T has 2 vertices of degree two , 4 vertices of degree three, 3 vertices of degree four, find the number of pendent vertices in T.

3. Construct an optimal prefix code for the symbols a,o,q,u,y,z that occur with the frequencies 20,28,4,17,12,7 respectively.

4. Apply the merge sort to the list (a) -1,7,4,11,5,-8,15,-3,-2,6,10,3. (b) -1,0,2,-2,3,6,-3,5,1,4

5. Obtain an optimal prefix code for the message (a) “FALL OF THE WALL”. (b) MISSION SUCCESSFUL. Indicate the code for the message

6. Define isomorphism. Verify two graphs are isomorphic



7. Define the following terms and give an example for each
(a) Complete graph (b) Euler circuit (c) Path (d) Bipartite graph (e) Regular graph (f) simple graph (g) Complement of graph (h) Binary Tree

8. Define tree. Prove that a tree with n vertices has n-1 edges

9. Determine $|V|$ for the following graphs
(i) G has 9 edges and all vertices have degree 3.
(ii) G is regular with 15 edges.
(iii) G has 10 edges and 2 vertices of degree 4 and all other vertices of degree 3

10. Define graph and degree of vertex of graph. Prove that in every graph the number of vertices of odd degree is even.