

(3 Hours)

Total Marks: 80

- N.B:** 1) Question **number 1** is compulsory.
 2) Attempt **any three** out of the remaining.
 3) Assume suitable data if **necessary** and justify the assumptions.
 4) Figures to the **right** indicate full marks.

Q 1

- A** Explain image space and object space [5]
B What is computer graphics and explain its applications [5]
C What are homogeneous coordinates and discuss its use in computer graphics [5]
D Explain point clipping with suitable example [5]

Q 2

- A** Explain mid point ellipse drawing method for region I with suitable diagrams [10]
B Given a triangle ABC with coordinates A (10,10), B (100,10), C(10,100). [10]
 Rotate the triangle by 90^0 Find the new coordinates of the triangle.

Q 3

- A** Explain area subdivision method with suitable example. [10]
B Explain antialiasing techniques in detail [10]

Q 4

- A** Explain Liang Barsky line clipping method with suitable example [10]
B Explain and write matrices for 3D rotation about X, Y and Z axes [10]

Q 5

- A** Derive the 2D transformation matrix for rotation with respect to fix point. [10]
B Calculate all the points on the line from point A(8,10) to point B(16,14) using [10]
 DDA line drawing method

Q 6

- A** What is window and viewport. Derive the transformation matrix for a window-to- [10]
 viewport transformation
B Discuss traditional animation techniques [10]

(Time: 3 hours)

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N.B. (1) Question No. 1 is compulsory.

(2) Answer any three questions from Q.2 to Q.6.

(3) Figures to the right indicate full marks

Q.1 a) Find $L(t + e^t + \cos t)^2$ [5]

Q.1 b) Find the Fourier series for $f(x) = x \sin x$ in $(-\pi, \pi)$ [5]

Q.1 c) Find Karl Pearson's coefficients of correlation between X and Y from the following data [5]

X	100	200	300	400	500
Y	30	40	50	60	70

Q.1 d) If $f(z) = (x^3 + axy^2 + bxy) + i(3x^2y + cx^2 + y^2 + dy^3)$ is analytic, then find a, b, c, d [5]

Q.2 a) A random variable X has the following probability function [6]

X	1	2	3	4	5	6	7
P(X=x)	k	2k	3k	k ²	k ² +k	2k ²	4k ²

Find i) k, ii) $P(X \geq 4)$, iii) $P(X < 5)$

Q.2 b) Determine the analytic function whose real part is $u = e^x \cos y$ [6]

Q.2 c) Evaluate $\int_0^\infty e^{-t} \cosh t \cos 2t dt$. [8]

Q.3 a) Obtain the Fourier series for $f(x) = \left(\frac{\pi-x}{2}\right)^2$ in the interval $(0, 2\pi)$ [6]

Q.3 b) A continuous random variable X has the p.d.f. $f(x) = kx^2 e^{-x}$, $x \geq 0$ [6]

Find i) k, ii) $P(1 \leq x \leq 2)$

Q.3 c) Find $L^{-1} \left[\frac{s+29}{(s+4)(s^2+9)} \right]$ using partial fraction method [8]

Q.4 a) Find $L[f(t)]$, where $f(t) = \cos t$, $0 < t < \pi$ and $f(t) = 0$, $t > \pi$ [6]

Q.4 b) Compute Spearman's rank correlation coefficient for the following data [6]

X	18	20	34	52	12
Y	39	23	35	18	46

Q.4 c) Obtain the Fourier series for [8]

$$f(x) = \begin{cases} 1, & 0 \leq x \leq \pi \\ 2 - \frac{\pi}{x}, & \pi \leq x \leq 2\pi \end{cases}$$

Q.5 a) Find $L^{-1} \left[\frac{4s+13}{s^2+8s+13} \right]$ [6]

Q.5 b) Find $L[(1 + \sin 2t)^2]$ [6]

Q.5 c) Find the line of regression of Y on X for the following data [8]

X	5	6	7	8	9	10	11
Y	11	14	14	15	12	17	16

Q.6 a) Find mean and variance for the following distribution [6]

X	8	12	16	20	24
P(X = x)	1/8	1/6	3/8	1/4	1/12

Q.6 b) Find i) $L^{-1}[\cot^{-1} 2s]$ ii) $L^{-1} \left[\log \left(1 + \frac{4}{s^2} \right) \right]$ [6]

Q.6 c) Prove that the function $f(z) = e^{2z}$ is analytic. Also, find its derivative. [8]

Time:3Hours

Max. Marks: 80

N.B.

- 1) **Q.1 is compulsory.**
- 2) Solve any 3 questions out of remaining 5 questions.
- 3) Assumptions made should be clearly stated.
- 4) Draw the figures wherever required.

Q.1 Solve any four of the following questions.

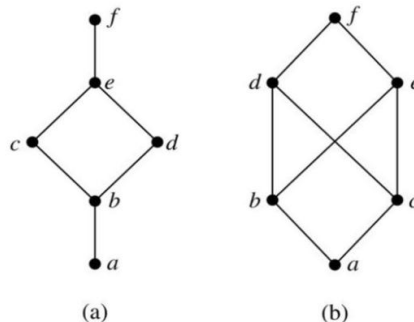
- a) Check if $(p \rightarrow q) \rightarrow [(\sim p \rightarrow q) \rightarrow q]$ is a tautology? 5
- b) Draw the Hasse diagram for $[\{2,4,5,8,10,12,20,25\}, /]$. Is it a Poset? 5
- c) Define Eulerian and Hamiltonian Graph. Give examples of following type of graph 5
 - i) Eulerian but not Hamiltonian
 - ii) Not Eulerian but Hamiltonian
- d) Explain types of Quantifiers . Represent the following sentences using Quantifiers 5
 - i) All hardworking students are clever.
 - ii) There is a student who can speak Hindi but does not know Marathi
- e) State the Pigeonhole principle and prove that in any set of 29 persons at least five persons must have been born on the same day of the week 5

Q.2

- a) Show that the set of all positive rational numbers forms an abelian group under the composition * defined by $a*b=(ab)/2$ 10
- a) What is a transitive closure? Explain Warshall's algorithm for finding transitive closure with an example. 10

Q.3

- a) By using mathematical induction, prove that the given equation is true for all positive integers. 6
 $1 \times 2 + 3 \times 4 + 5 \times 6 + \dots + (2n - 1) \times 2n = n(n+1)(4n-1)/3$
- b) Define Lattice? Which of the following is lattice? 8



- c) Determine the sequence of which recurrence relation is $a_n = 2a_{n-1} - a_{n-2}$ with initial conditions $a_1= 1.5, a_2= 3$. 6

Q.4

- a) Let $A = \{1, 3, 6, 9, 15, 18, 21\}$ & R be the relation of divisibility. 8
- i) Write the pairs in a relation set R .
 - ii) Construct the Hasse diagram.
 - iii) What are the Maximal and Minimal elements?
 - iv) Is this poset a distributive lattice? Justify your answer.

- b) 6

Let $H = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ be a parity check matrix. Determine $(3, 6)$ group code $e_H : B^3 \rightarrow B^6$

- c) Write a short note on Types of Graphs. 6

Q.5

- a) Let $(Z, *)$ be an algebraic structure, where Z is set of integers and the operation $*$ is defined by $a*b = \text{maximum of } (a,b)$. Is $(Z, *)$ a Semigroup? Is $(z, *)$ a Monoid? Justify your answer. 8

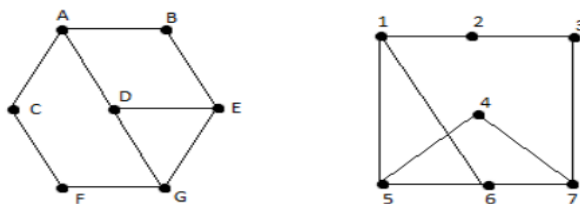
- b) Define the term Surjective function. Let E be the set of all even numbers then $f: N \rightarrow E: f(x) = 2x$, check if it is surjective, bijective? Justify your answer. 4

- c) Give the examples of relation R on $S = \{a, b, c, d\}$ having stated property. 8

- i) R is an equivalence relation.
- ii) R is symmetric but not transitive
- iii) R is both symmetric and antisymmetric
- iv) R is neither symmetric nor antisymmetric.

Q.6

- a) Define Isomorphic graphs and check whether the following graphs are Isomorphic ? 8



- b) In a group $(G, *)$, Prove that the inverse of any element is unique and identity element is also unique. 6

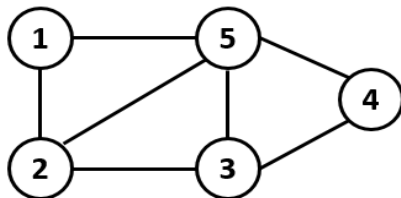
- c) Define Relation. Let 6
- f: $R \rightarrow R$ is defined as $f(x) = x^2$
 - g: $R \rightarrow R$ is defined as $g(x) = 3x^2 + 1$
 - h: $R \rightarrow R$ is defined as $h(x) = 9x - 2$
- find $(hof)og, go(foh)$.

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 (2) Attempt any three questions out of the remaining five questions
 (3) Figures to the right indicate full marks
 (4) Make suitable assumptions wherever necessary with proper justifications

- Q1 A What is Hashing? Explain Hash collision with example. [05]
 B Explain types of Double Ended Queue with example. [05]
 C Differentiate between arrays and linked list. [05]
 D List different data structures along with one application. [05]
- Q2 A Construct Binary Search Tree by inserting the following elements in sequence [10]
 45, 28, 34, 63, 87, 76, 31, 11, 50, 17.
 B Write a program in C to implement Queue using singly linked list. [10]
- Q3 A Write a program to perform the following operations on doubly linked list: [10]
 i) Insert a node at the front of the list
 ii) Delete a node from the front of the list
 iii) Count the number of nodes in the list
 iv) Display the list
 B Define Graph. Show the adjacency matrix and adjacency list representation for [05]
 the following graph



- C Explain stack overflow and underflow conditions with example. [05]
- Q4 A Write an algorithm to check the well-formedness of parenthesis. [10]
 B Show the result of inserting the elements 16, 18, 5, 19, 11, 10, 13, 21, 8, 14 one [10]
 at a time into an initially empty AVL tree.
- Q5 A Define tree traversal. Explain binary tree traversal techniques with example. [10]
 B A hash table of size 10 uses linear probing to resolve collisions. The key values [10]
 are integers and the hash function used is $key \% 10$. Draw the table that results
 after inserting in the given order the following values:
 28, 55, 71, 38, 67, 11, 10, 90, 44, 9
- Q6 A Explain Depth First Search and Breadth First Search traversal of a graph with [10]
 example.
 B Construct Huffman tree and determine the code for each symbol in the string [10]
 "PROGRAMMING".

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|----|---|--|----|
| Q1 | A | Differentiate between Computer organization and computer architecture | 05 |
| | B | Draw the flow chart for of Restoring division algorithm | 05 |
| | C | Differentiate between Hardwired control unit and Micro programmed control unit | 05 |
| | D | Explain IEEE 754 floating point representations. | 05 |
| Q2 | A | Draw the flow chart Booths algorithm for multiplication and Perform 6×2 | 10 |
| | B | Describe the detailed Von-Neumann Model with a neat block diagram | 05 |
| | C | Explain Cache coherence | 05 |
| Q3 | A | Explain the different addressing modes. | 10 |
| | B | Define Instruction cycle and draw the state diagram of instruction cycle | 05 |
| | C | Explain Bus arbitrations | 05 |
| Q4 | A | Explain Micro instruction format and write a micro program for the instruction
MUL R_1, R_2 | 10 |
| | B | Explain Hardwired Control Unit and the various design methods associated with it. | 10 |
| Q5 | A | Explain various Memory mapping techniques | 10 |
| | B | Explain the concept of Locality of reference | 05 |
| | C | List & Explain the Characteristics of Memory | 05 |
| Q6 | A | Explain Flynn's classification. | 10 |
| | B | Describe Instruction Pipelining and its hazards. | 10 |
