

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER– III EXAMINATION – SUMMER 2026****Subject Code:3130702****Date:17-06-2026****Subject Name:Data Structures****Time:02:30 PM TO 05:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
Q.1	(a) Define data structure. What are the applications of data structures?	03
	(b) Explain the concept of amortized time complexity with an example.	04
	(c) Explain the bubble sort algorithm. How can you optimize bubble sort to reduce the number of swaps?	07
Q.2	(a) How does a linked list differ from an array in terms of structure and memory allocation?	03
	(b) Describe the concept of a double-ended queue and its uses.	04
	(c) Write an algorithm to convert infix expression into postfix expression using stack.	07
	OR	
	(c) Write an algorithm to insert an element after the given node in the singly linked list.	07
Q.3	(a) Describe the basic operations that can be performed on linear data structures.	03
	(b) Explain the tower of Hanoi problem.	04
	(c) Write a short note on AVL tree.	07
	OR	
Q.3	(a) What is multiple stack? How it is useful?	03
	(b) Describe how insertion and deletion operations are applied to the priority queue.	04
	(c) Write a short note on 2-3 tree.	07
Q.4	(a) Define: 1. Sibling 2. Height of tree 3. Forest	03
	(b) Describe a weighted graph and its applications.	04
	(c) Explain breadth-first search (BFS) algorithm.	07
	OR	
Q.4	(a) How new node can be inserted into a binary search tree?	03
	(b) Describe a cyclic graph and an acyclic graph with examples.	04
	(c) Discuss Dijkstra's algorithm for finding the shortest path.	07
Q.5	(a) Describe the characteristics of a good hash function.	03
	(b) Apply merge sort on the following array. A=[38, 27, 43, 10]	04
	(c) Explain indexed sequential file and sequential file structure.	07
	OR	
Q.5	(a) Explain random file organization.	03
	(b) Sort the elements 77, 49, 25, 12, 9, 33, 56, 81 using selection sort.	04
	(c) Describe any two collision resolution techniques.	07

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-III EXAMINATION – SUMMER 2025

Subject Code:3130702

Date:29-05-2025

Subject Name:Data Structures

Time:02:30 PM TO 05:00 PM

Total Marks:70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

- Q.1** (a) What is the best-case, average-case, and worst-case time complexity analysis? **03**
- (b) Explain row-major order and column-major order representation of 2-D array. **04**
- (c) Construct a Binary Search Tree for the following data. **07**
21, 51, 12, 45, 17, 71, 19, 47, 78.
Write Pre-order, In-order, and Post-order traversal of constructed BST.

- Q.2** (a) Define following terms: **03**
1. Full Binary Tree 2. Complete Binary Tree 3. Skewed Binary Tree
- (b) Write the importance of asymptotic analysis. Is $O(n \log_2 n^2)$ faster than $O(n^2)$? Justify your answer with an example. **04**
- (c) Convert the following infix expression into a postfix expression using stack. **07**
 $(a+b)^{(c*d)/(e-f)}$

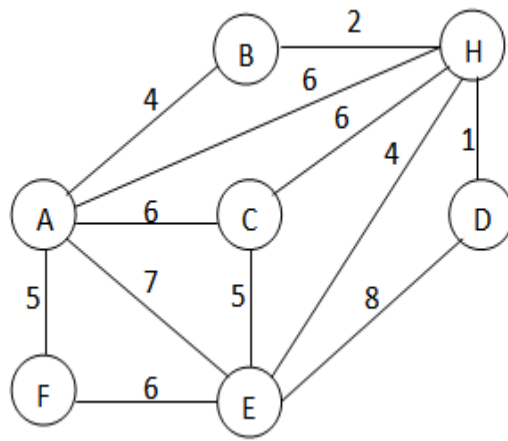
OR

- (c) Write an algorithm to convert infix expression into postfix expression. **07**
- Q.3** (a) Illustrate how stack is used in the recursion. **03**
- (b) Describe Threaded Binary Tree with example. **04**
- (c) Write a C program for the following operations on a circular queue. **07**
1. Insert 2. Delete 3. Display

OR

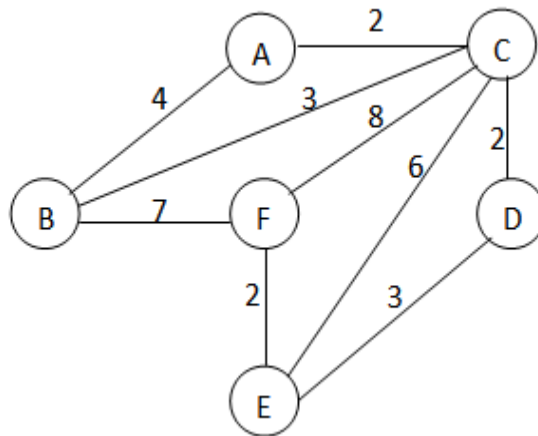
- Q.3** (a) Write a recursive solution for Tower of Hanoi problem. **03**
- (b) Explain the DFS traversal of the graph with an example. **04**
- (c) Write an algorithm to sort existing singly linked list in ascending order according to the information field. **07**

- Q.4** (a) Define the following terms: **03**
1. Field 2. Record 3. File
- (b) Sort the following data using merge sort. **04**
50, 20, 70, 05, 30, 80, 55, 25
- (c) Find the minimum spanning tree of the following graph using Kruskal's algorithm. **07**



OR

- Q.4**
- (a) What is hashing? Write the properties of a good hash function. **03**
 - (b) Sort the following data using quick sort. **04**
50, 30, 80, 40, 35, 70, 60, 20, 75
 - (c) Find the shortest path from A to F using Dijkstra's Algorithm. **07**



- Q.5**
- (a) Compare linear search and binary search in terms of their time complexity. **03**
 - (b) Write a C program for a bubble sort. **04**
 - (c) What is hash collision? Explain collision resolution techniques. **07**

OR

- Q.5**
- (a) Does a pivot selection method affect the time complexity of quick sort? Justify your answer. **03**
 - (b) Write a C program for a selection sort. **04**
 - (c) List various file organizations and explain one in detail. **07**

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-III (NEW) EXAMINATION – SUMMER 2024****Subject Code:3130702****Date:19-07-2024****Subject Name: Data Structures****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

MARKS

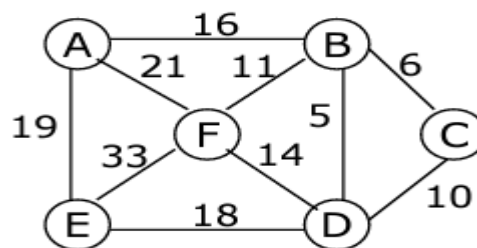
- Q.1**
- | | | |
|-----|---|-----------|
| (a) | Explain data structure. Enlist and explain the importance of data structure. | 03 |
| (b) | Define time and space complexity. Derive time complexity of merge sort. | 04 |
| (c) | 1) Evaluate the postfix expression in tabular forms: $2\ 5\ 3\ -\ *\ 8\ /\ 4\ +$ | 03 |
| | 2) Evaluate the prefix expression in tabular forms: $\ /\ 7\ *\ 1\ +\ 4\ -\ 6\ 3$ | 04 |

- Q.2**
- | | | |
|-----|---|-----------|
| (a) | Explain Tower of Hanoi with suitable example. | 03 |
| (b) | Define hash function. Explain it with suitable example. | 04 |
| (c) | Write an algorithm for the following stack operations.
1) PUSH 2) POP 3) DISPLAY | 07 |

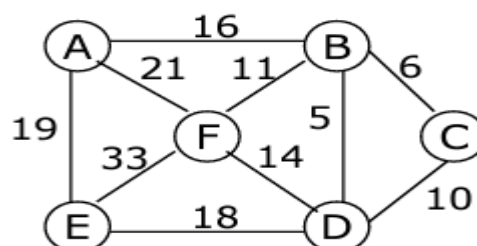
OR

- | | | |
|-----|--|-----------|
| (c) | Write an algorithm for the following queue operations.
1) INSERT 2) DELETE 3) DISPLAY | 07 |
|-----|--|-----------|

- Q.3**
- | | | |
|-----|---|-----------|
| (a) | Write an algorithm to add a node into a binary search tree. | 03 |
| (b) | Explain Dequeue and Priority queue in detail. | 04 |
| (c) | Construct the minimum spanning tree using prim's algorithm for the following graph. | 07 |

**OR**

- Q.3**
- | | | |
|-----|---|-----------|
| (a) | Write an algorithm to delete an item from the doubly linked list. | 03 |
| (b) | Differentiate: BFS and DFS. | 04 |
| (c) | Construct the minimum spanning tree using krushkal's algorithm for the following graph. | 07 |



- Q.4** (a) Define the terms below: **03**
1) Threaded Tree 2) Acyclic graph 3) Sparse matrix
(b) Explain AVL tree in detail with suitable example. **04**
(c) Construct a binary tree from the traversals given below: **07**
Inorder : D, B, E, H, A, I, F, C, G
Preorder : A, B, D, E, H, C, F, I, G

OR

- Q.4** (a) Define the terms below: **03**
1) Complete Binary Tree 2) Forest 3) Abstract data type
(b) Explain 2-3 tree in brief. **04**
(c) Write an algorithm to insert an item as below: **07**
1) At the start of the linked list
2) At the end of the linked list

- Q.5** (a) Define file. Explain its types. **03**
(b) Explain bubble sort with suitable example. **04**
(c) Build a chained hash table of 10 memory locations. Insert the keys 121, 3, 4, 31, 61, 24, 7, 87, 8, 9 in hash table using chaining. Use $h(k) = k \bmod m$ ($m=10$). **07**

OR

- Q.5** (a) Define file organization. Explain different file organizations. **03**
(b) Sort the following array elements using insertion sort algorithm. **04**
8, -2, 5, 3, 9, 4, 6
(c) Explain Dijkstra's shortest path using suitable example. **07**

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-III(NEW) EXAMINATION – SUMMER 2023****Subject Code:3130702****Date:26-07-2023****Subject Name:Data Structures****Time:02:30 PM TO 05:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

- Q.1**
- (a) What is DS? Explain data structure and its types. **03**
 - (b) Explain Tower of Hanoi with example. **04**
 - (c) Write algorithms to insert, and delete elements in queue **07**
- Q.2**
- (a) Construct Binary Tree where the preorder traversal is 1,2,4,5,3,6,8,9,7 & postorder is 4,5,2,8,9,6,7,3,1. **03**
 - (b) Construct an AVL Tree by inserting numbers from 1 to 8. **04**
 - (c) What is stack? Explain operations on stack in detail. **07**
- OR**
- (c) Explain tree traversal in detail with example. **07**
- Q.3**
- (a) Explain 2-3 Tree in brief. **03**
 - (b) Explain any three hashing techniques with example. **04**
 - (c) What is problem with simple queue? Explain its solution with example and algorithms. **07**
- OR**
- Q.3**
- (a) Explain binary search technique. **03**
 - (b) Explain fastest sorting technique with example. **04**
 - (c) What is collision? Explain collision resolution techniques with example. **07**
- Q.4**
- (a) List all asymptotic notations and explain any one of it. **03**
 - (b) List and explain linked list applications. **04**
 - (c) What is doubly linked list? Write Algorithm for insertion and deletion in doubly linked list. **07**
- OR**
- Q.4**
- (a) What is file? Explain types of files. **03**
 - (b) Convert the following infix expressions to their prefix.
($A^B * C - D + E / F / (G + H)$) **04**
 - (c) Explain Prim's & Kruskal's algorithm with suitable example **07**
- Q.5**
- (a) Explain malloc and free functions in 'C'. **03**
 - (b) Define the following: 1. Sibling 2. Forest 3. Complete Binary Tree 4. Complete Graph **04**
 - (c) Explain following: (i) Recursion (ii) Nonprimitive data structures (iii) Hashing (iv) Non- linear data structures (v) sparse matrix (vi) Priority queue (vii) Collision **07**
- OR**
- Q.5**
- (a) What is time complexity? Explain with example. **03**
 - (b) Explain Binary Search with example. **04**
 - (c) Write and explain algorithm for insertion in Singly Linked List **07**