

**B. Tech.**  
**(SEM III) ODD SEMESTER EXAMINATION 2022-23**  
**DATA STRUCTURE**

[TIME: 3 hrs.]

[Max. Marks: 100]

Note: Attempt All Questions. All Question carry equal marks. Make suitable assumptions wherever necessary.

Q1. Answer ALL parts.

Marks

- (a) Define circular linked list. Write the function to perform the following operation in a doubly linked list 5
- (i) Creation of list of nodes , (ii) Insertion after at specific nodes /  
 (iii) Delete the node at a given position /
- (b) A double dimension array MAT [20] [30] is stored in computer's main storage as column major. If the address of MAT [15] [23] is 4850 and address of MAT[12][18] is 4232, then find the base address, width (W) and also calculate the address of MAT[16][25] 5
- (c) Define the following terms in brief: 5
- (i) Time complexity (ii) Space complexity  
 (iii) Asymptotic Notation

OR

Two arrays of integers in ascending order are given. Develop an algorithm to merge these arrays into third sorted array in ascending order.

- (d) Represent the polynomial  $5x^3 + 4x^2 + 3x + 2$  in computer memory using linked list. 5

OR

Write a procedure to reverse the order of elements a list using linked list data structure. ,

Q2. Answer ALL parts.

- (a) (i) Write an algorithm for evaluating a postfix expression and evaluate the following postfix expression using the algorithm  $AB+CD/AD-EA\wedge + *$  10  
 Where  $A=2, B=7, C=9, D=3, E=5$ .
- (ii) Convert the following expression into its corresponding postfix form using the prescribed algorithm:  $(300 + 23) * (43 - 21) / (84 + 7)$ . Do the evaluation of resultant postfix expression.
- (b) Define dequeue. Write the function to perform the following operation in a dequeue 10
- (i) Insertion at Rear (ii) Insertion at Front  
 (iii) Deletion at Rear (iv) Deletion at Front

OR

Double linked list takes more space than single linked list for storing one extra address. Under what condition, could a double linked list more beneficial than single linked list. Justify with an example.

**Q3.** Answer ALL parts.

- (a) Explain merge sort algorithm with an example. Mention the best case and worst-case time complexity of merge sort algorithm. 10

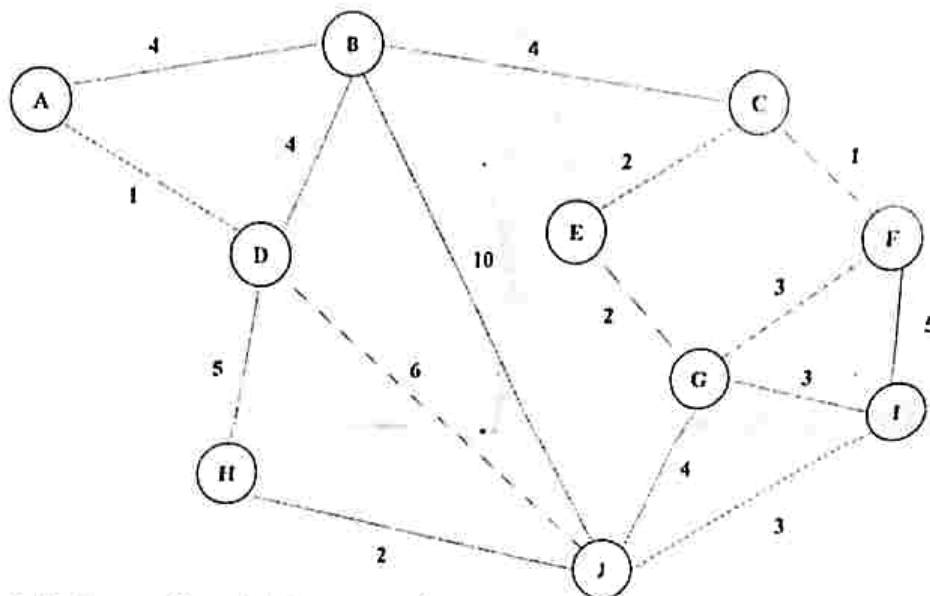
**OR**

Write an algorithm to sort elements using heap sort technique. Illustrate the working of heap sort algorithm on the following input: 35,15,0,1,60.

- (b) Discuss the binary search algorithm with a suitable example. Also, explain its best case, average and worst case complexities.

**Q4.** Answer ALL parts.

- (a) Apply Prim's algorithm on the following graph to obtain a minimum spanning tree. Show all steps. 10



- (b) Differentiate between Breadth first search (BFS) and Depth first search (DFS) algorithm of graph traversal with an example. 10

**OR**

Explain Warshall's algorithm with the help of an example.

**Q5.** Answer ALL parts.

- (a) Construct an AVL search tree by inserting the following elements in the order of their occurrence. 10  
64, 1, 44, 26, 13, 110, 98, 85

**OR**

Show the structure of the binary search tree after adding each of the following values in that order:

J, R, D, G, T, E, M, H, P, A, F, Q.

What is the height of the created binary search tree? Describe the tree after node M is deleted and the node D is also deleted from your built tree.

- (b) Can you find a unique tree when any two traversals are given? Using the following traversals construct the corresponding binary tree: 10

INORDER: H K D B I L E A F C M J G

PREORDER: A B D H K E I L C F G J M

Also, find the postorder traversal of obtained tree.

B. TECH.

(SEM IV) EVEN SEMESTER EXAMINATION 2023-24  
BASICS DATA STRUCTURE AND ALGORITHMS

[TIME: 3 hrs.]

[Max. Marks: 70]

Note: Attempt All Questions. All Question carry equal marks. Make suitable assumptions wherever necessary.

Q1 Answer ALL parts. Marks  
(a) Define an algorithm. Why is it important to consider the efficiency of an algorithm? Explain with an example. 3.5

OR

Discuss the significance of asymptotic notations in algorithm analysis.  
(b) Write a C program to create a singly linked list and implement the operations "Insert a node at the end". 3.5

OR

Write a C program to search an element in a single-dimensional array.  
(c) Define doubly linked list. Explain how an element can be deleted from doubly linked list using C program. 3.5  
(d) Define an array. Write the formula to calculate the address of an element in a row-major order 2D array. 3.5

Q2 Answer ALL parts.

(a) Write a C functions to implement the push and pop operations in a stack using an array. 7

OR

Write an algorithm for conversion of an infix expression to a postfix expression. Use this algorithm to convert the following infix expression into its equivalent postfix expression.

$$((A + B) * D) \uparrow (E - F)$$

(b) Explain the concept of a circular queue and discuss how it overcomes the limitations of a simple queue. Also, compare it with deque. 7

Q3 Answer ALL parts.

(a) Discuss the Inorder, Preorder and Postorder tree traversal algorithms. A binary tree  $T$  has 9 nodes. The inorder and preorder traversals of  $T$  are as follows:  
Inorder: E A C K F H D B G  
Preorder: F A E K C D H G B  
Draw the tree  $T$ . 7

OR

What is a Binary Search Tree (BST)? Show the structure of the binary search tree after adding each of the following values in order into an empty binary search tree:

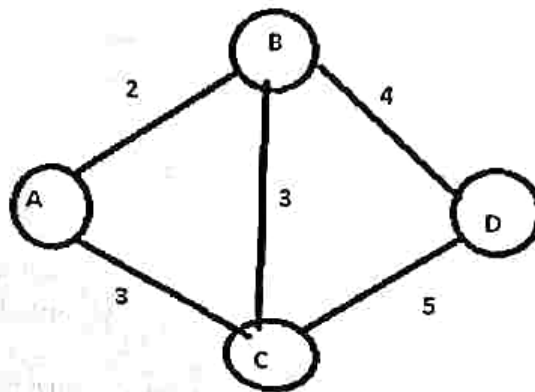
J, R, D, G, T, E, M, H, P, A, F, Q

What is the height of the created binary search tree?

- (b) Define the following terms:
  - (i) Strictly binary tree
  - (ii) Complete binary tree
  - (iii) Extended binary tree

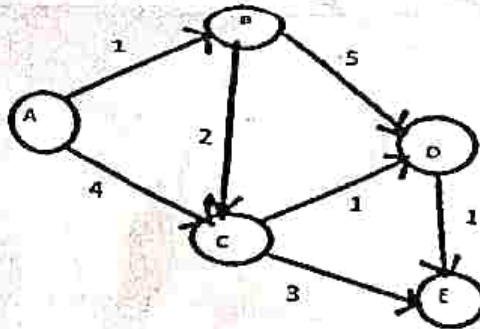
Q4 Answer ALL parts.

- (a) Describe the difference between depth-first search (DFS) and breadth-first search (BFS) in graph traversal. Your differentiation also includes an example for each traversal. 7
- (b) Write Prim's algorithm for finding a minimum spanning tree of a graph. Use Prim's algorithm to find the minimum spanning tree for the following graph. Show all steps clearly. 7



OR

Consider the following weighted graph. Use Dijkstra's algorithm to find the shortest path from vertex A to all other vertices. Show your work step-by-step.



Q5 Answer ALL parts.

- (a) Differentiate between binary search and linear search. Describe how binary search works. Write a C function to implement binary search on a sorted array of integers. 7
- (b) Explain the selection sort algorithm and demonstrate its steps with an example array. Write a C function to perform selection sort on an array of integers. 7

OR

Write an algorithm for sorting a list in ascending order using mergesort algorithm. Give trace of the algorithm for the following data.

66, 33, 40, 22, 55, 88, 60, 11, 80, 20, 50, 44, 77, 30