

KADI SARVA VISHWAVIDHYALAYA
B.E. Semester III Examination
(Dec- 2023)

Data Structures and Algorithms

Branch : CE/IT/CSE

DATE:16/12/2023

TIME:12:00 PM to 3:00 PM

Subject Code : CT 303 N

TOTAL MARKS: 70

Instructions:

- 1 Answer each section in separate answer sheet.
- 2 All questions are **Compulsory**.
- 3 Indicate **clearly**, the options you attempt along with its respective question number.
- 4 Use the last page of main supplementary for **rough work**.

SECTION –I

- Q-1 A Define and explain Primitive and Non Primitive Data Types. 5
- B How does Array differ from Linked List. 5
- C Convert $((A+B^C^D)*(E+F/G))$ infix expression into postfix format showing stack status after every step 5

OR

- C What are the advantages of postfix & prefix expression? Evaluate the following postfix expression: $546+*493/+*$ 5

- Q-2 A Consider a circular queue of size 4. Initialize Front and Rear=0. Perform following operations: [Insert A, Insert B, Insert C, Delete, Insert D, Insert E, Delete, Insert F, Delete]. State the contents of queue after each operation. 5
- B Write the algorithm for inserting a new node at the end of the Singly Linked List 5

OR

- A Write the algorithm for inserting a new node before the address X in Doubly Linked List 5
- B Write the Algorithm for Insertion and Deletion in a Simple Queue. 5
- Q-3A Which data structure is used for finding the traversal of Breadth First Search? Explain BFS with its algorithm. 5
- B Explain the data structures required to represent the graph. 5

OR

- A Which data structure is used for finding the traversal of Depth First Search? Explain DFS with its algorithm. 5
- B What is the advantage of using AVL tree over simple Binary Search Tree? State the application of Tree data structure. 5

SECTION – II

- Q-4 A Define the following terms. 1) Graph 2) Tree 3) Adjacency Matrix 4) Complete Binary tree 5) Minimum Spanning Tree 5
- B What is a binary search tree? Create a binary search tree for inserting the following data. Keys: 50, 45, 100, 25, 49, 120, 105, 46, 90, 95 5
- C Construct a binary tree from the traversals given below: 5
Inorder: BIDACGEHF
Postorder: IDBGCHFEA

OR

- C List out different traversal ways of tree and demonstrate any two with example. 5
- Q-5 A Write the algorithm of bubble sort and apply Bubble sort on following array to sort it in ascending order : 5
10,5,3,20,15,25,17,60.
- B Which data structure is used during the implementation of recursion? State any 1 applications of recursion and Explain it in detail. 5

OR

- A Write the algorithm of Merge Sort and apply it on following array to sort it in ascending order: 30,40,20,10,60,70. 5
- B Explain Linear Search algorithm with an example. 5
- Q-6A Explain file in terms of fields, records and database. 5
- B Explain the problem of Collision in Hashing. Discuss any 1 collision resolution technique in detail with an example. 5

OR

- A Explain Indexed and Relative/Random File Organization 5
- B Define Hashing. Insert following keys into the hash table with Chaining as collision resolution technique 5
Keys : 10,5,26,43,92,41,20,63
 $H(k)=k \bmod 10$
Size of Hash Table =7

BEST OF LUCK

KADI SARVA VISHWAVIDYALAYA**BE SEMESTER-III(New) Regular Examination December-2022****Subject Name: Data Structures and Algorithms****Subject Code: CT303-N****Date:14/12/2022****Time: 10:00 am to 1:00 pm****Total Marks: 70**

Instructions:

1. Answer each section in separate answer sheet.
2. Use of scientific calculator is permitted.
3. Indicate clearly, the option you attempt along with its respective question number.

Section-I

Q-1 (A) Explain significance of Data structures. Compare primitive and non-primitive data structures. [5]

(B) Convert the following infix expressions into postfix expression [5]

a. $(A+B) * D + E / (F + A * D) + C$

b. $A/B^{\wedge}O + D * E - A * C$ (^ stands for exponentiation)

(C) Explain the problem of tower of Hanoi and trace the algorithm for number of disks=3 [5]

OR

(C) Explain recursive algorithm to find out factorial of given number and trace the algorithm for n=4. [5]

Q-2 (A) Explain insertion and deletion algorithms for circular queue. [5]

(B) Define single linked list and explain algorithm for deleting a node from a single linked list. [5]

OR

(A) Explain insertion and deletion algorithms for simple queue. [5]

(B) Define doubly linked list and explain algorithm for inserting a node in a doubly linked list. [5]

Q-3 (A) Write an algorithm for Heap sort & sort the following data using heap sort. [5]
20, 65, 43, 53, 78, 10, 78, 40, 39, 29

(B) The values given below are to be inserted in a hash table with 5 locations using chaining to resolve collisions. Construct hash table and use simple hash function. [5]
1,2,3,4,5,10,21,22,33,34,15,32,31,48,49,50

OR

(A) What is hashing? Explain external and internal hashing in detail. [5]

(B) Write an algorithm for quick sort & sort the following data using quick sort. [5]
10, 23, 64, 21, 74, 95, 2, 59, 44, 87, 55

Section-II

- Q-4** (A) Define the following terms: [5]
- a. Depth of a tree
 - b. Graph
 - c. Minimum Spanning tree
 - d. Weighted Graph
 - e. Complete Binary tree
- (B) Explain algorithm for Binary Search. Compare Binary search and Linear Search. [5]
- (C) Write a short note on sequential file organization. [5]
- OR**
- (C) Explain structure of index sequential file. [5]
- Q-5** (A) Construct Binary search tree for the following data [5]
- 10,3,15,22,6,45,65,23,78,34,5
- (B) Explain DFS algorithm with example. [5]
- OR**
- (A) Construct binary tree for the given preorder and inorder traversals. [5]
- Preorder: GBQACKFPDERH
Inorder: QBKCFAGPEDHR
- (B) Explain adjacency matrix and adjacency list representation for a graph with example. [5]
- Q-6** (A) Explain Threaded Binary tree. [5]
- (B) Explain Dijkstra's algorithm with example. [5]
- OR**
- (A) Create AVL tree for the following data [5]
- 28,73,89,75,74,13,10
- (B) Explain Prim's Algorithm with example. [5]

-----All the Best-----

KADI SARVA VISHWAVIDYALAYA**BE SEMESTER-III (New) ATKT Examination JUN-2022****Subject Name: Data Structures and Algorithms****Subject Code: CT303-N****Date: 09/06/2022****Time: 12:30pm to 03:30pm****Total Marks: 70**

Instructions:

1. Answer each section in separate answer sheet.
2. Use of scientific calculator is permitted.
3. Indicate clearly, the option you attempt along with its respective question number.

Section-I

- Q-1 (A)** Define Data structure. Explain Linear and Nonlinear data structures with example. [5]
(B) Define the Following Terms: [5]

1) Sparse Matrix

2) Recursion

3) Priority queue

4) Traversal

5) Primitive Data type.

- (C)** What is Tower of Hanoi? Explain Tower of Hanoi with $n=5$. [5]

OR

- (C)** Trace the algorithm showing stack to calculate the factorial of $n=5$. [5]

- Q-2 (A)** Convert the following **infix** expression to **postfix** expression along with showing status of all data structures at each step: $(A + B) * C + D / (E + F * G) - H$. [5]

- (B)** Explain DQUEUE in detail with insertion and deletion algorithms. [5]

OR

- (A)** Convert the following Postfix expression to infix expression: [5]

1) $ABCDE - + * EF * -$ 2) $AB - C + DEF - + *$

- (B)** What is Stack? Explain algorithms for inserting and deleting an element into stack with diagram. [5]

- Q-3 (A)** Write an algorithm to insert a node from Singly link list. [5]

- (B)** What is searching? Write an algorithm of Binary Search. Also Give the difference between Binary Search and Linear Search. [5]

OR

- (A)** Write the difference between the terms given below. [5]

1) Array and Stack

2) Singly linked list and doubly linked list

- (B)** Write an algorithm to delete an element into Doubly link list. [5]

Section-II

- Q-4** (A) Explain Collision Resolution Technique with example. [5]
 (B) Explain AVL tree with example. [5]
 (C) Write an algorithm of Merge Sort, and sort the numbers 35,2,55,20,80,10,40,60,5,25 using Merge Sort. [5]

OR

- (C) Sort the numbers 10,23,64,21,74,95,2,59,44,87,55 using Quick Sort. [5]

- Q-5** (A) Construct a tree for the given inorder and postorder traversals. And also find preorder traversal for that tree. [5]
 Inorder: -DGBAHEICF
 Postorder: -GDBHIEFCA

- (B) Explain B-trees with examples. [5]

OR

- (A) Construct a binary search tree for following elements: [5]
 45,15,79,90,10,55,12,20,50,65,8.

Reconstruct this tree after following Operations:

- 1) Node 35 and 99 is added.
 2) After adding Node 20 is deleted.
 (B) Write a short note on BFS and DFS in graph. [5]

- Q-6** (A) Create a Minimum Spanning Tree (MST) of graph shown in **Fig-1** using Prim's and Krushkal's method by showing tracing of algorithms (consider (a) as start node). [5]

- (B) Write a short note on Indexed File Organization. [5]

OR

- (A) (i) Show the possible adjacency matrix and adjacency list representation for the graph given in **Fig 2**. [3]

- (ii) Define the terms: 1) Null Graph 2) Weight Graph [2]

- (B) Using the modulo-division method and linear probing. Store the keys shown below in an array with 19 elements. How many collisions occurred? What is the resultant hash table? [5]

224562,137456,214562

140145,214576,162145

144467,199645,234534.

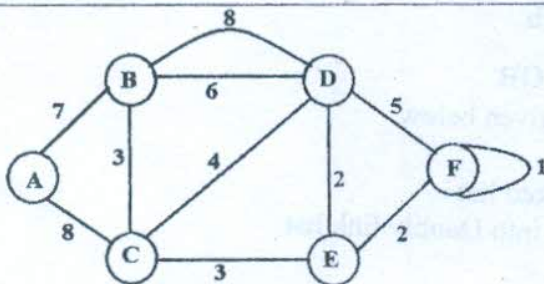


Fig - 1

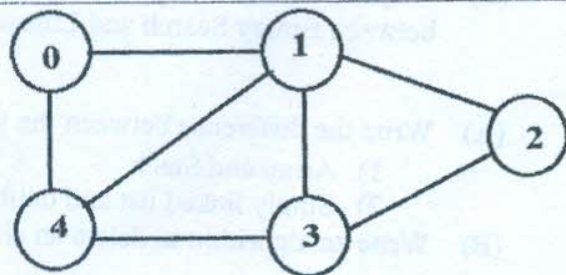


Fig - 2

Seat No: _____

KADI SARVA VISHWAVIDYALAYA

BE SEMESTER-III (New) Regular Examination February / March – 2022

Subject: Data Structure and Algorithms

Subject Code: CT303-N

Date: 02-03-2022

Time: 11:00 AM to 2:00 PM

Total Marks: 70

Instructions:

1. Answer each section in separate answer sheet.
2. Use of scientific calculator is permitted.
3. Indicate clearly, the option you attempt along with its respective question number.
4. Start new answer from a new page.

Section – I

Que-1

- (A) What is data structure? Describe various types of data structures with suitable examples. [5]
- (B) Differentiate the following. [5]
- a. Array Vs Linked-List
 - b. Stack Vs Queue
- (C) What is the limitation of a simple queue? Write an algorithm to insert an element into a circular queue. [5]

OR

(C) What is stack? Write applications of the stack. Explain any one with example. [5]

Que-2

- (A) Write an algorithm to convert infix expression to postfix expression. [5]
(B) Describe the **tower of Hanoi problem**. Write an algorithm to solve the tower of Hanoi for n discs. [5]

OR

(A) Convert an **infix** expression: $(A+B)*C+D / (B+A*C) + D$ into **postfix** expression. Show stack contents after each symbol. [5]

(B) Write algorithms of stack operations. PUSH, POP and DISPLAY. [5]

Que-3

- (A) What is **Double Ended Queue**? Write algorithms to perform the following operations. Enqueue_Front and Dequeue_Rear. [5]
- (B) Explain the following operations of **Doubly Linked List** with example. Insert_First and Insert_Last. [5]

OR

Que-3

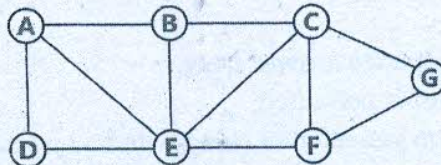
- (A) What is searching? Explain the **binary search** technique with suitable example. [5]
- (B) Explain Enqueue and Dequeue operations of simple **queue using a Singly Linked List**. [5]

Section – II

- Que-4**
- (A) Write a note on Sequential File and Indexed-Sequential File. [5]
- (B) Write an algorithm of Bubble Sort. Trace the algorithm on the following data: 50, 11, 8, 20, 14, 3, 5, 12, 15, 7 [5]
- (C) Write an algorithm to implement a Quick Sort. [5]

OR

- (C) Define Graph. Apply **Breadth First Search** algorithm on the following graph. [5]

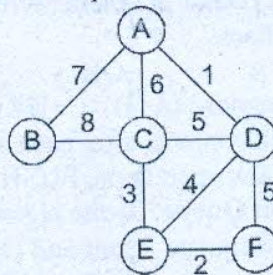


- Que-5**
- (A) What is an AVL tree? Explain various rotations with suitable examples. [5]
- (B) Construct a **binary tree** using following traversal results. [5]
- Pre-Order: P A S T Q E D X M R C F
- In-Order : T S Q A E D P M X C R F

OR

- (A) Write an algorithm of Simple merge sort. Sort the following data using Two-way merge sort. [5]
- 45 24 37 27 17 28 40 12 20 25
- (B) What is Collision in Hashing? Explain any two collision resolution techniques with examples. [5]

- Que-6**
- (A) What is max heap and min heap? Describe **heapify** operation to construct a max heap tree. [5]
- (B) What is minimum spanning tree? Apply **Krushkal's** algorithm on the following graph. Show each steps of MST construction. [5]



OR

- (A) List various hashing techniques. Explain any four with example. [5]
- (B) Write a detailed note on 2-3 Tree with example. [5]

Seat No. _____

KADI SARVA VISHWAVIDYALAYA

BE SEMESTER-III (New) Regular Examination JANUARY-2022

Subject Name: Data Structures and Algorithms

Subject Code: CT303-N

Date: 19/01/2022

Time: 12:30pm to 03:30pm

Total Marks: 70

Instructions:

1. Answer each section in separate answer sheet.
2. Use of scientific calculator is permitted.
3. Indicate clearly, the option you attempt along with its respective question number.

Section-I

Q-1 (A) Explain about Linear Data Structures with necessary examples and diagrams. [5]

(B) Answer the following questions. (Compulsory to write question of your answer)

- (i) Let S is an instance of the Stack. Consider the following sequence of operations performed on S, which initially contains element 55 as top most elements. What is the status of top of stack after execution of each step? [1]

```
S.push(33);  
S.push(20);  
S.pop();  
S.pop();  
S.push(10);  
S.push(40);  
S.pop();
```

- (ii) Let Q be an instance of a Queue. Q.enqueue(x) is insertion and Q.dequeue() deletion functions. Consider the following code and determine what will be the value of the variable count, when completes its execution? And show trace for every step. [2]

```
Q.enqueue(1);  
int count=1;  
do  
{  
    count=count+1;  
    x = Q.dequeue();  
    Q.enqueue( 2*x );  
    Q.enqueue( 4*x );  
} while(x != 32);
```

- (iii) Evaluate the given **infix** expression $24-2^6+10/2+4*2$ by showing stack status at each stage. [2]

(C) Trace the algorithm showing stack to solve the **Tower of Hanoi** problem for $n=3$. [5]

OR

(C) Trace the algorithm showing stack to calculate the **factorial** of $n=5$. [5]

Q-2 (A) Convert the following **infix** expression to **postfix** expression along with showing status of all data structures at each step: $A+(((B-C)*(D-E)+F)/G) \text{ } \$ \text{ } (H-J)$ [5]

(B) Explain DQUEUE in detail with insertion and deletion algorithms. [5]

OR

- (A) Write an algorithm to convert **postfix** expression to **infix**. Also write trace to convert a postfix expression: **AB-CDE+ * +FG+ -** in to **infix** with status contents. [5]
- (B) Explain Priority Queue in detail with management of priority queue data after insertion and deletion operations performed on it. [5]

- Q-3 (A) Write an algorithm to **delete** a node from **Singly link list**. [5]
- (B) Write an algorithm of Binary Search. Show the trace to search **x=55** from sequence of data **88, 38, 23, 62, 55, 51, 23**. [5]

OR

- (A) Convert the following expression into **prefix and postfix** [5]
- (i) $(A + B) * (C * (D - E) + F) - G$ (ii) $(A + B * C * D) * ((E + F) / D)$
- (B) Write an algorithm to **insert** an element into **Doubly link list**. [5]

Section-II

- Q-4 (A) List the different file organization techniques. Explain any four in detail. [5]
- (B) Write a short note on Threaded Binary tree. [5]
- (C) Write an algorithm of **Merge Sort**, and sort the numbers **20, 14, 50, 3, 5, 7, 11, 8, 12, 15** using Merge Sort. [5]

OR

- (C) Sort the numbers **20, 14, 50, 3, 5, 7, 11, 8, 12, 15** using **Quick Sort**. [5]
- Q-5 (A) Write recursive algorithms of **Inorder, Preorder and Postorder** tree traversals. Derive all traversal sequences of binary tree shown in Fig-1. [5]
- (B) Insert **38, 75, 85, 15** in the **AVL Tree** shown in Fig-2. Draw rebalancing of tree after every insertion. [5]

OR

- (A) Write answers for following operations with respect to **Binary Search Tree (BST)** [5]
- (i) Construct BST for data 52, 27, 62, 26, 22, 45, 97, 33, 16, 49, 35, 88.
- (ii) Reconstruct tree of **operation-(i) output** by performing operations:
1. Node 90 is added. 2. Node 26 is deleted.
- (B) Traverse the graph shown in Fig-3 using **Breath First Search** and **Depth First Search** and show final BFS and DFS tree for derived traverse sequence. [5]

- Q-6 (A) Sort the numbers **77, 12, 8, 39, 27, 21, 44, 18, 6, 47, 11, 37, 60, 56** using **Heap Tree** by showing status of tree structures at each step. [5]
- (B) List the different types of Hashing Techniques. Explain each with suitable example. [5]

OR

- (A) Create a Minimum Spanning Tree (MST) of graph shown in Fig-4 using **Prim's** and **Kruskal's** method by showing tracing of algorithms (consider (a) as start node). [5]
- (B) Given the key inputs 4322, 1334, 1471, 9679, 1989, 6171, 6173, 4199 and the hash function $h(\text{key}) = \text{key} \% 9$. Draw the memory allocation table along with resolution of collision (if any) using **Linear probing**. [5]

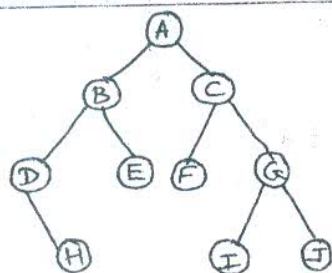


Fig-1

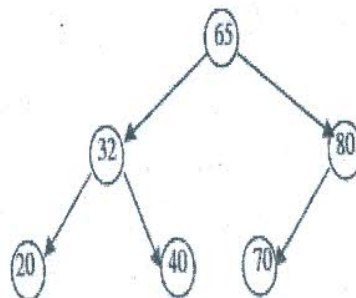


Fig-2

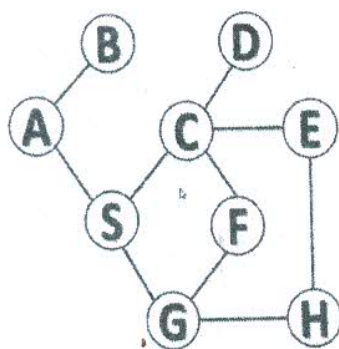


Fig-3

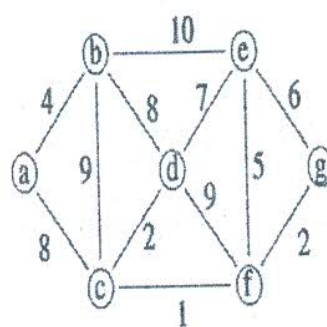


Fig-4