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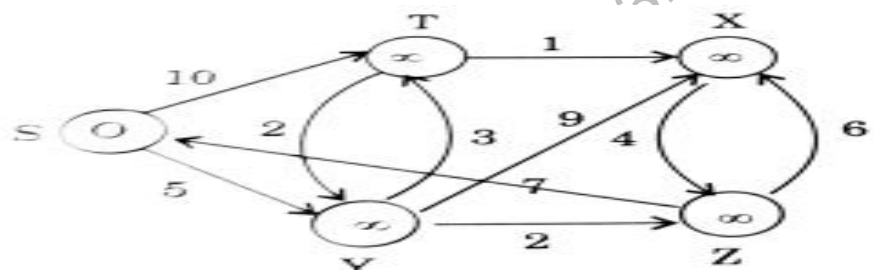
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BTECH
(SEM III) THEORY EXAMINATION 2023-24
DATA STRUCTURE

TIME: 3HRS**M.MARKS: 70****Note: 1.** Attempt all Sections. If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief.****2 x 7 = 14**

Q no.	Question	Marks	CO
a.	What are the various asymptotic notations?	2	1
b.	Why are parentheses needed to specify the order of operations in infix expressions but not in postfix operations?	2	2
c.	How the choice of pivot element effects the running time of quick sort algorithm?	2	3
d.	What are the 2 different forms of hashing?	2	3
e.	What is the significance of binary tree in Huffman algorithm?	2	4
f.	What is the number of edges in a regular graph of degree d and n vertices.	2	5
g.	Write an algorithm to obtain the connected components of a graph.	2	5

SECTION B**2. Attempt any three of the following:****7 x 3 = 21**

a.	Write a Pseudo code that will concatenate two linked lists. Function should have two parameters, pointers to the beginning of the lists and the function should link second list at the end of the first list.	7	1
b.	Write an algorithm to convert a valid arithmetic infix expression into an equivalent postfix expression. Trace your algorithm for following infix expression. A+B*C-D/F	7	2
c.	What are the disadvantages of linear probing in hashing? Discuss how quadratic probing can be used to solve some of these problems.	7	3
d.	Write C function for non-recursive post order traversal.	7	4
e.	Consider the following graph and using Dijkstra Algorithm find the shortest path. 	7	5

SECTION C**3. Attempt any one part of the following:****7 x 1 = 7**

a.	Each element of an array Data [20][50] requires 4 bytes of storage. Base address of Data is 2000. Determine the location of Data [10][10] when the array is stored as: (i) Row major (ii) Column major	7	1
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BTECH
(SEM III) THEORY EXAMINATION 2023-24
DATA STRUCTURE

TIME: 3HRS**M.MARKS: 70**

b.	How will you create link list representation of a polynomial. Explain it with the suitable example.	7	1
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4. Attempt any one part of the following: 7 x 1 = 7

a.	Write an algorithm to evaluate an arithmetic expression using stack and show how the expression $3*(5-3)$ will be evaluate.	7	2
b.	A double ended Queue (deque) is a linear list in which additions may be made at either end. Obtain a data representation mapping a deque into one dimensional array. Write C function to add and delete elements from either end of deque.	7	2

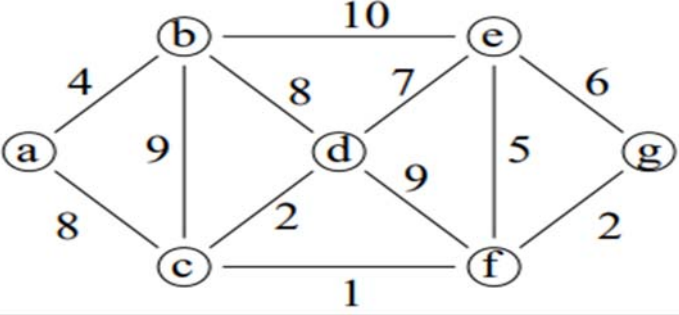
5. Attempt any one part of the following: 7 x 1 = 7

a.	Write a C program for sorting 100 integer numbers wring selection sort procedure. Discuss the worst-case time complexity of the algorithms.	7	3
b.	Write a program in C language to implement binary search algorithm. Also discuss the average behavior of the algorithm.	7	3

6. Attempt any one part of the following: 7 x 1 = 7

a.	If E and I denotes the external and internal path length of a binary tree having n internal nodes then show that $E=I+2n$.	7	4
b.	Suppose character a, b, c, d,e,f has probabilities 0.07, 0.09, 0.12, 0.22, 0.23, 0.27 respectively. Find an optional Huffman code and draw the Huffman tree. What is the average code length?	7	4

7. Attempt any one part of the following: 7 x 1 = 7

a.	Find the minimum spanning tree using Prim's algorithm for the graph shown below: - 	7	5
b.	Write a program in C language to compute the indegree and outdegree of every vertex of a directed graph when the graph is represented by an adjacency matrix.	7	5

B.TECH
(SEM III) THEORY EXAMINATION 2022-23
BASIC DATA STRUCTURE & ALGORITHMS

Time: 3 Hours

Total Marks: 100

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt all questions in brief.

2x10=20

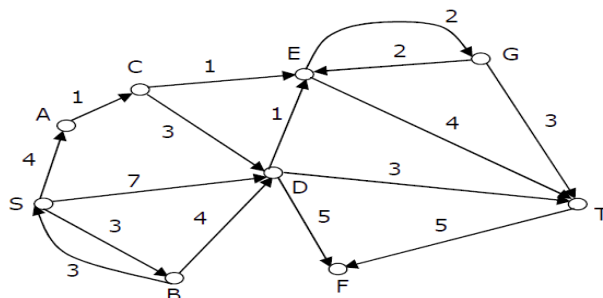
- (a) Define algorithm and its characteristics.
- (b) List the various asymptotic notations? Explain Big Oh notations along with suitable diagram.
- (c) In the reference of Tower of Hanoi problem if there are 7 disks. Solve the number of years will it need to move from one tower to another, assume that one move takes 1 second.
- (d) Explain circular queue. What is the condition if circular queue is full?
- (e) Differentiate strict and Complete Binary Tree.
- (f) Define Binary heaps.
- (g) Explain Transitive closure of a Graph.
- (h) List the different types of representation of graphs
- (i) Differentiate Internal and External Sorting.
- (j) State the number of swaps perform by bubble sort to sort the following array of integer 9,2,3,5,4,1,10,8,7,

SECTION B

2. Attempt any three of the following:

10x3=30

- (a) Consider a multi-dimensional Array in C language ARR [20] [30] [40] and address of ARR [2][3][4] is 1000. Calculate the address of ARR [6] [7] [8] in row major order and column major order. Assume the first element is stored at ARR [1][2][3] and each element take 2 bytes.
- (b) Write a C program to delete a node from Kth position in singly linked list.
- (c) Construct an expression tree for the following algebraic expression.
 $(3a-b) \uparrow 2(4c+2d) \uparrow 3$
Note: \uparrow is exponent operator.
- (d) Find the single source shortest path for following graph using Dijkstra algorithm.



- (e) Compare B tree and B+ tree with suitable example.

SECTION C

3. Attempt any *one* part of the following: **10x1=10**
- (a) Consider a 2-dimension array LTM [10...100] [10...80] in lower triangular matrix (LTM) representation. The size of each element in array is 2 bytes. If the array is implemented in the memory in the form of row major order and base address of array is 1000, then write the address of LTM [30][40].
 - (b) Write a complete C program to add to polynomial using singly linked list.
4. Attempt any *one* part of the following: **10x1=10**
- (a) Implement C language to print Fibonacci series using recursive and non-recursive function.
 - (b) Write an algorithm to evaluate postfix expression also find the value of 7,5,2,-,* ,4,1,5,-,/,+.
5. Attempt any *one* part of the following: **10x1=10**
- (a) For a binary tree T, the preorder and in-order traversal sequences are as follows :
In order: B C A E G D H F I J
Preorder: A B C D E G F H I J
 - (i) Construct a binary Tree.
 - (ii) What is its post-order traversal sequence?
 - (b) A networking company uses a compression technique to encode the message before transmitting over the network. Suppose the piece of message (each character occupies 7 bits) written in *italic* letter.
when you are on the left you are on the right. when you are on the right, you are on the wrong.
Suggest the answer to following question based on above problem.
 - (i) Construct Huffman tree.
 - (ii) Decode the message following message 1011110101011111111100.
 - (iii) Calculate the percentage of space saved in the message after compression?
6. Attempt any *one* part of the following: **10x1=10**
- (a) Write sort notes on following.
 - (i) Topological Sort
 - (ii) Activity Network
 - (b) Differentiate between Breadth First Search (BFS) and Depth First Search (DFS) with suitable example.
7. Attempt any *one* part of the following: **10x1=10**
- (a) Write an algorithm for Merge Sort. Explains with the help of suitable example.
 - (b) Construct a B-Tree of order 5 with the following sequence of integer.
10,90,20,80,30,70,40,60,50,35,55,15,25,5,75,85,95,45,100,22,12.



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BTECH
(SEM III) THEORY EXAMINATION 2021-22
BASIC DATA STRUCTURE AND ALGORITHMS

Time: 3 Hours

Total Marks: 100

Note: Attempt all Sections. If you require any missing data, then choose suitably.

SECTION A

1. Attempt all questions in brief. 2*10 = 20

Qno	Questions	CO
(a)	What is big oh in asymptotic notation?	1
(b)	Write the application of sparse matrix.	1
(c)	What is the condition if circular queue is full?	2
(d)	Write the two advantages of circular singly linked list over singly linked list.	2
(e)	Differentiate internal sorting and external sorting also enlists the name of one sorting techniques of each.	5
(f)	What is difference between tree and graph?	4
(g)	Show the maximum number of node in a binary tree of height h is $2^{h+1}-1$.	3
(h)	What is difference between polish notation and reverse polish notation?	2
(i)	Write the advantages of B ⁺ tree?	3
(j)	How to select Pivot element in quick sort?	5

SECTION B

2. Attempt any three of the following: 10*3 = 30

Qno	Questions	CO
(a)	What is difference between static and dynamic memory allocation?	1
(b)	Write an algorithm to evaluate postfix expression using stack.	2
(c)	How to delete a node in binary search tree? Explain with the help of example.	3
(d)	Explain Dijiskatra Algorithm with the help of example.	4
(e)	Binary search is more efficient than Linear search. Justify your answer.	5

SECTION C

3. Attempt any one part of the following: 10*1 = 10

Qno	Questions	CO
(a)	In 2-D array, each element of an array X [5] [4] requires 4 bytes of storage. Base address of X is 80. Determine the location of X [3] [2]. When the array is stored at Row major order and column major order.	1
(b)	Write a program in 'C' to implementation of reverse singly linked list.	2

4. Attempt any one part of the following: 10 *1 = 10

Qno	Questions	CO
(a)	Convert the following infix expression into postfix expression using stack. $A*(B+D)/E-F*(G+H/K)$	2
(b)	Write a program in 'C' to implementation of QUEUE.	2



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BTECH
(SEM III) THEORY EXAMINATION 2021-22
BASIC DATA STRUCTURE AND ALGORITHMS

5. Attempt any *one* part of the following: 10*1 = 10

Qno	Questions	CO
(a)	Write an algorithm to in-order tree traversal of binary tree. Also Construct the binary tree of the following given traversal order In-order : M, E, P, A, Q, T, R, C, F, K. Post-order: M, P, E, Q, R, C, T, K, F, A.	3
(b)	Construct the steps to configure a B- tree of order 5 for the following data: 78, 21, 11, 97, 85, 74, 63, 45, 42, 57, 20, 16, 19, 32, 30, 31	3

6. Attempt any *one* part of the following: 10*1 = 10

Qno	Questions	CO
(a)	Discuss the breadth first search traversal algorithm with example.	4
(b)	What is Minimum cost of spanning tree? Explain kruskal's algorithm with example.	4

7. Attempt any *one* part of the following: 10*1 = 10

Qno	Questions	CO
(a)	Write a quick sort algorithm. Use quick sort algorithm to sort the following element: 15, 22, 30, 10, 15, 64, 1, 3, 9, and 52.	5
(b)	Write short notes on the following: (i) Priority Queue. (ii) Threaded binary tree	5

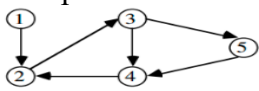


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B. TECH
(SEM III) THEORY EXAMINATION 2020-21
DATA STRUCTURES

Time: 3 Hours**Total Marks: 100****Note: 1.** Attempt all Sections. If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief.****2 x 10 = 20**

Q no.	Question	Marks	CO
a.	Define Time-Space trade-off.	2	1
b.	Differentiate Array and Linked list.	2	1
c.	Explain Tail Recursion with suitable example.	2	2
d.	Write the full and empty condition for a circular queue data structure.	2	2
e.	Examine the minimum number of interchanges needed to convert the array 90, 20, 41, 18, 13, 11, 3, 6, 8, 12, 7, 71, 99 into a maximum heap.	2	3
f.	Differentiate sequential search and binary search.	2	3
g.	Compute the Transitive closure of following graph. 	2	4
h.	Write short notes on adjacency multi list representation a Graph.	2	4
i.	What is the importance of threaded binary tree?	2	5
j.	Write short notes on min heap.	2	5

SECTION B**2. Attempt any three of the following:**

Q no.	Question	Marks	CO
a.	Consider a multi-dimensional Array A[90] [30] [40] with base address starts at 1000. Calculate the address of A[10] [20] [30] in row major order and column major order. Assume the first element is stored at A[2][2][2] and each element take 2 byte.	10	1
b.	Evaluate the following postfix expression using stack. 2 3 9 * + 2 3 ^ - 6 2 / + , show the contents of each and every steps. also find the equivalent prefix form of above expression. Where ^ is an exponent operator.	10	2
c.	Explain any three commonly used hash function with the suitable example? A hash function H defined as $H(\text{key}) = \text{key} \% 7$, with linear probing, is used to insert the key 37, 38, 72, 48, 98, 11, 66 into a table indexed from 0 to 6. what will be the location of key 11? Justify your answer, also count the total number of collisions in this probing.	10	3
d.	Write an algorithm for Breadth First search (BFS) and explain with the help of suitable example.	10	4
e.	If the in order of a binary tree is B, I, D, A, C, G, E, H, F and its post order is I, D, B, G, C, H, F, E, A then draw a corresponding binary tree with neat and clear steps from above assumption.	10	5



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SECTION C**3. Attempt any one part of the following:**

Q no.	Question	Marks	CO
a.	Consider the two dimensional lower triangular matrix (LTM) of order N ,Obtain the formula for address calculation in the address of row major and column major order for location LTM[j][k], if base address is BA and space occupied by each element is w byte.	10	1
b.	Write a C program to insert a node at k th position in single linked list.	10	1

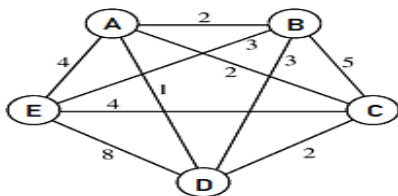
4. Attempt any one part of the following:

Q no.	Question	Marks	CO
a.	Convert the following infix expression to reverse polish notation expression using stack. $x = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$	10	2
b.	Write a C program to implement stack using single linked list.	10	2

5. Attempt any one part of the following:

Q no.	Question	Marks	CO
a.	Write an algorithm for merge sort and apply on following elements 45,32,65,76,23,12,54,67,22,87.	10	3
b.	Write a C program for Index Sequential Search.	10	3

6. Attempt any one part of the following:

Q no.	Question	Marks	CO
a.	Describe Prim's algorithm and find the cost of minimum spanning tree using Prim's Algorithm. 	10	4
b.	Apply the Floyd warshall's algorithm in above mentioned graph (i.e. in Q.no 6a)	10	4

7. Attempt any one part of the following:

Q no.	Question	Marks	CO
a.	Write Short notes of following (a) Extended Binary Trees (b) Complete Binary Tree (c) Threaded Binary Tree.	10	5
b.	Insert the following sequence of elements into an AVL tree, starting with empty tree 71,41,91,56,60,30,40,80,50,55 also find the minimum array size to represent this tree.	10	5

B. TECH.
(SEM III) THEORY EXAMINATION 2019-20
DATA STRUCTURES

Time: 3 Hours

Total Marks: 100

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt all questions in brief.

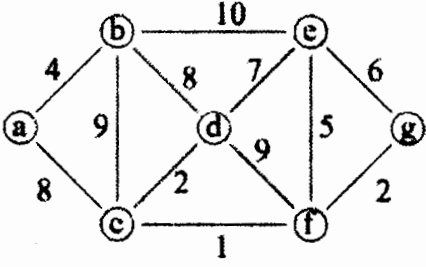
2 x 10 = 20

Qno.	Question	Marks	CO
a.	How can you represent a sparse matrix in memory?	2	CO1
b.	List the various operations on linked list.	2	CO1
c.	Give some applications of stack.	2	CO2
d.	Explain Tail recursion.	2	CO2
e.	Define priority queue. Given one application of priority queue.	2	CO3
f.	How does bubble sort work? Explain.	2	CO3
g.	What is Minimum cost spanning tree? Give its applications.	2	CO4
h.	Compare adjacency matrix and adjacency list representations of graph.	2	CO4
i.	Define extended binary tree, full binary tree, strictly binary tree and complete binary tree.	2	CO5
j.	Explain threaded binary tree.	2	CO5

SECTION B

2. Attempt any three of the following:

3 x 10 = 30

Qno.	Question	Marks	CO
a.	What are the merits and demerits of array? Given two arrays of integers in ascending order, develop an algorithm to merge these arrays to form a third array sorted in ascending order.	10	CO1
b.	Write algorithm for Push and Pop operations in stack. Transform the following expression into its equivalent postfix expression using stack: $A + (B * C - (D / E \uparrow F) * G) * H$	10	CO2
c.	How binary search is different from linear search? Apply binary search to find item 40 in the sorted array: 11, 22, 30, 33, 40, 44, 55, 60, 66, 77, 80, 88, 99. Also discuss the complexity of binary search.	10	CO3
d.	Find the minimum spanning tree in the following graph using Kruskal's algorithm: 	10	CO4
e.	What is the difference between a binary search tree (BST) and heap? For a given sequence of numbers, construct a heap and a BST. 34, 23, 67, 45, 12, 54, 87, 43, 98, 75, 84, 93, 31	10	CO5

SECTION C

3. Attempt any *one* part of the following:

$$1 \times 10 = 10$$

Qno.	Question	Marks	CO
a.	What is doubly linked list? What are its applications? Explain how an element can be deleted from doubly linked list using C program.	10	CO1
b.	Define the following terms in brief: <div style="display: flex; justify-content: space-around;"> <div> (i) Time complexity (ii) Asymptotic Notation </div> <div> (iii) Space complexity (iv) Big O Notation </div> </div>	10	CO1

4. Attempt any *one* part of the following:

$$1 \times 10 = 10$$

Qno.	Question	Marks	CO
a.	(i) Differentiate between iteration and recursion. (ii) Write the recursive solution for Tower of Hanoi problem.	10	CO2
b.	Discuss array and linked representation of queue data structure. What is dequeue?	10	CO2

5. Attempt any *one* part of the following:

$$1 \times 10 = 10$$

Qno.	Question	Marks	CO
a.	Why is quick sort named as quick? Show the steps of quick sort on the following set of elements: 25, 57, 48, 37, 12, 92, 86, 33 Assume the first element of the list to be the pivot element.	10	CO3
b.	What is hashing? Give the characteristics of hash function. Explain collision resolution technique in hashing.	10	CO3

6. Attempt any *one* part of the following:

$$1 \times 10 = 10$$

Qno.	Question	Marks	CO
a.	Explain warshall's algorithm with the help of an example.	10	CO4
b.	Describe the Dijkstra algorithm to find the shortest path. Find the shortest path in the following graph with vertex 'S' as source vertex.	10	CO4

```

graph LR
    S((S)) -- 10 --> A((A))
    S -- 5 --> C((C))
    A -- 1 --> B((B))
    A -- 3 --> C
    A -- 2 --> D((D))
    B -- 9 --> C
    B -- 4 --> D
    C -- 2 --> D
    D -- 6 --> B
    
```

7. Attempt any *one* part of the following:

$$1 \times 10 = 10$$

Qno.	Question	Marks	CO
a.	Can you find a unique tree when any two traversals are given? Using the following traversals construct the corresponding binary tree: 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 Post Order traversal of obtained tree.	10	CO5
b.	What is a B-Tree? Generate a B-Tree of order 4 with the alphabets (letters) arrive in the sequence as follows: a g f b k d h m j e s i r x c l n t u p	10	CO5