Roll No: | | | | | | | | | | | | | |

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

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. 2X10 = 20

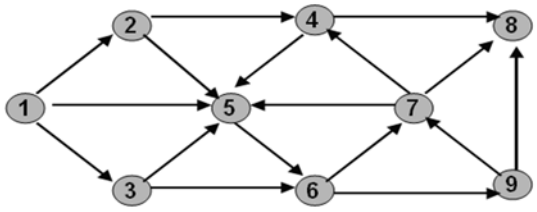
Q No	Questions	CO
(a)	Convert the infix expression (A+B) *(C-D) $E*F to postfix. Give the answer without any spaces.	1
(b)	Rank the following typical bounds in increasing order of growth rate: O(log n), $O(n^4)$, O(1), $O(n^2 \log n)$	2
(c)	Draw the binary search tree that results from inserting the following numbers in sequence starting with 11: 11, 47, 81, 9, 61, 10, 12,	3

(d)	What does the following recursive function do for a given Linked List with first node as head?
	void fun1(struct node* head)
	{
	if(head == NULL)
	return;
	fun1(head->next);
	printf("%d ", head->data);
	}
		4

(e)	Define a sparse matrix. Suggest a space efficient representation for space matrices.	5
(f)	List the advantages of doubly linked list over single linked list.	1
(g)	Give example of one each stable and unstable sorting techniques.	2
(h)	Write advantages of AVL tree over Binary Search Tree (BST)	3
(i)	What is tail recursion? Explain with a suitable example.	4
(j)	Write different representations of graphs in the memory.	5

SECTION B

2. Attempt any *three* of the following: 10X3 = 30

Q No	Questions	CO
(a)	Write advantages and disadvantages of linked list over arrays. Write a 'C' function creating new linear linked list by selecting alternate elements of a linear linked list.	**1**
(b)	Write algorithms of insertion sort. Implement the same on the following numbers; also calculate its time complexity. 13, 16, 10, 11, 4, 12, 6, 7	**2**
(c)	Differentiate between DFS and BFS. Draw the breadth First Tree for the above graph. 	**3**
(d)	Differentiate between liner and binary search algorithm. Write a recursive function to implement binary search.	**4**
(e)	What is the significance of maintaining threads in Binary Search Tree? Write an algorithm to insert a node in thread binary tree.	**5**

SECTION C

3. Attempt any *one* part of the following: 10X1 = 10

Q No	Questions	CO
(a)	Suppose a three dimensional array A is declared using A[1:10, -5:5, -10:5) (i) Find the length of each dimension and the number of elements in A (ii) Explain Row major order and Column Major Order in detail with explanation formula expression.	1

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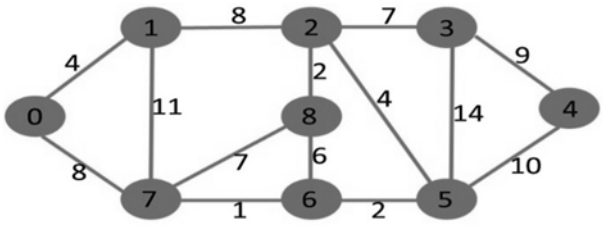
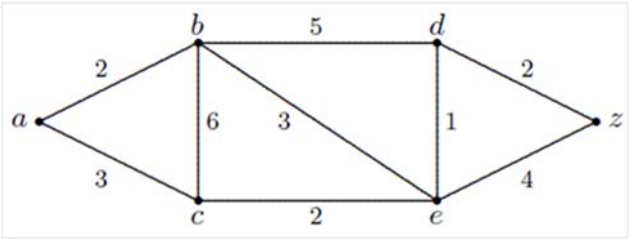
(b)	Discuss the representation of polynomial of single variable using linked list. Write 'C' functions to add two such polynomials represented by linked list.	1

4. **Attempt any *one* part of the following:** **10 X1 = 10**

Q No	Questions	CO
(a)	(i) Use the merge sort algorithm to sort the following elements in ascending order. 13, 16, 10, 11, 4, 12, 6, 7. What is the time and space complexity of merge sort? (ii) Use quick sort algorithm to sort 15,22,30,10,15,64,1,3,9,2. Is it a stable sorting algorithm? Justify.	2
(b)	(i) The keys 12, 17, 13, 2, 5, 43, 5 and 15 are inserted into an initially empty hash table of length 15 using open addressing with hash function h(k) = k mod 10 and linear probing. What is the resultant hash table? (ii) Differentiae between linear and quadratic probing techniques.	2

5. **Attempt any *one* part of the following:** **10X1 = 10**

Q No	Questions	CO
(a)	Use Dijkstra's algorithm to find the shortest paths from source to all other vertices in the following graph.  	3
(b)	Apply Prim's algorithm to find a minimum spanning tree in the following weighted graph as shown below.  	3

6. **Attempt any *one* part of the following:** **10X1 = 10**

Q No	Questions	CO
(a)	(i) Write an iterative function to search a key in Binary Search Tree (BST). (ii) Discuss disadvantages of recursion with some suitable example.	4
(b)	(i) What is Recursion? (ii)Write a C program to calculate factorial of number using recursive and non-recursive functions.	4

7. **Attempt any *one* part of the following:** **10X1 = 10**

Q No	Questions	CO
(a)	(i) Why does time complexity of search operation in B-Tree is better than Binary Search Tree (BST)? (ii) Insert the following keys into an initially empty B-tree of order 5 a, g, f, b, k, d, h, m, j, e, s, i, r, x, c, l, n, t, u, p (iii) What will be the resultant B-Tree after deleting keys j, t and d in sequence?	5
(b)	(i) Design a method for keeping two stacks within a single linear array so that neither stack overflow until all the memory is used. (ii) Write a C program to reverse a string using stack.	5