

2024

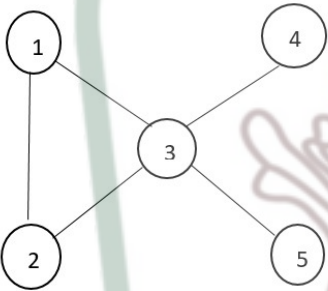
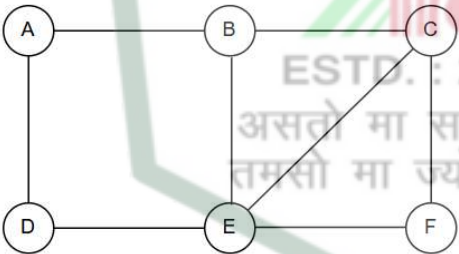
Data Structures and Algorithms

Full Marks : 100

Time: Three hours

*The figures in the margin indicate full marks for the questions.**Answer any five questions.*

1.	a)	What is linear data structure? Give examples.	3
	b)	What do you mean by time complexity? Discuss any two asymptotic notations for measuring the time complexity of an algorithm.	2+6=8
	c)	Write an algorithm to delete an element from a given position of an array.	4
	d)	Let A be a nxn square matrix. Write a module that finds the number NUM of nonzero elements in A.	5
2.	a)	Find the worst-case time complexity of bubble sort algorithm.	4
	b)	Write an algorithm to search for an element from a singly linked list.	5
	c)	Suppose LIST is a header circular linked list in memory. Write an algorithm that deletes the last node from LIST.	6
	d)	What do you mean by recursion? Explain how we can evaluate the factorial of a number recursively using a stack.	2+3=5
3.	a)	Write an algorithm to implement the insertion operation to a circular queue.	6
	b)	What do you mean by priority queue?	2
	c)	Explain the working principle of the merge sort technique. Write the partitioning and the merging procedure of the merge sort.	3+3+6=12
4.	a)	Define a complete binary tree. Calculate the depth of a complete binary tree having 1000 nodes.	2+3=5
	b)	Draw a binary tree that corresponds to the following algebraic expression. $(2x+y)(5a-b)^3$. Use ^ for exponentiation and * for multiplication. Also, find the preorder and postorder traversals of the above tree.	5+2+2=9
	c)	Consider the following traversals of a binary tree T. Preorder: G, B, Q, A, C, K, F, P, D, E, R, H Inorder: Q, B, K, C, F, A, G, P, E, D, H, R	6

		Draw the tree T.	
5.	a)	Apply heap sort to arrange the following elements in ascending order. 82,90,10,12,15,77,55,23	8
	b)	What do you mean by an AVL search tree? Construct an AVL search tree from the following list of elements. 70,7,20,32,19,116,104,91	8
	c)	Define the following	2+2=4
	i.	Path	ii. Degree of a node
6.	a)	State the differences between BFS and DFS. Consider the following graph and find the corresponding BFS and DFS traversals. 	6+4=10
	b)	Consider the connected graph G.  Find all simple paths from A to F.	5
	c)	What is an adjacency matrix? Explain with the help of an example.	5
7.	a)	Define hashing. Explain different hash functions with examples. Discuss the properties of a good hash function.	2+9+3=14
	b)	What do you mean by collision? The keys 12, 18, 13, 2, 3, 23, 5 and 15 are inserted into an initially empty hash table of length 10 using open addressing with hash function $h(k) = k \text{ mod } 10$ and linear probing. What is the resultant hash table?	2+4=6