Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Engineering

End Sem (Odd) Examination Dec-2022

EC3ET04 Data Structures

Programme: B.Tech. Branch/Specialisation: EC

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. Which data structure allows deleting data elements from front and inserting at rear? **1**

(a) Stacks (b) Queues

(c) Deques (d) Binary search tree

ii. Which of the following statement about stack data structure is NOT correct? **1**

(a) Linked List are used for implementing Stacks

(b) Top of the Stack always contain the new node

(c) Stack is the FIFO data structure

(d) Null link is present in the last node at the bottom of the stack

iii. For a given graph G having v vertices and e edges which is connected and has no cycles, which of the following statements is true? **1**

(a) v = e (b) v = e+1 (c) v + 1 = e (d) v = e+2

iv. Identify the reason which doesn't play a key role to use threaded binary trees? **1**

(a) The storage required by stack and queue is more

(b) The pointers in most of nodes of a binary tree are NULL

(c) It is Difficult to find a successor node

(d) They occupy less size

v. _____ is a complete binary tree that is completely filled except possibly at the bottom level. **1**

(a) Red-Black Tree (b) AVL Tree

(c) Binary Heap Tree (d) Double tree

P.T.O.

vi. While deleting nodes from a binary heap, _____ node is replaced by the last leaf in the tree. **1**
(a) Left leaf (b) Right leaf
(c) Root (d) Cycle

vii. A sort which relatively passes through a list to exchange the first element with any element less than it and then repeats with a new first element is called- **1**
(a) Insertion sort (b) Selection sort
(c) Heap sort (d) Quick sort

viii. The quick sort algorithm exploits _____ design technique. **1**
(a) Greedy (b) Divide and Conquer
(c) Dynamic programming (d) Backtracking

ix. What is a hash function? **1**
(a) A function has allocated memory to keys
(b) A function that computes the location of the key in the array
(c) A function that creates an array
(d) A function that computes the location of the values in the array

x. The Worst case occur in linear search algorithm when- **1**
(a) Item is somewhere in the middle of the array
(b) Item is not in the array at all
(c) Item is the last element in the array
(d) Item is the last element in the array or is not there at all

Q.2 i. Write down an algorithm for pushing an item into the stack. **2**

ii. What are the limitations of simple queues? How it can be overcome? Explain diagrammatically with the help of an example also write an algorithm for deleting a node from simple queue. **8**

OR iii. Explain different types of linked list with diagram and also write algorithm for inserting a node at the beginning of linked list **8**

Q.3 i. Define graph. Explain the following types of graphs with the help of a graph(diagram): **4**
(a) Weighted graph (b) Complete graph
(c) Connected graph (d) Disconnected graph

ii. The following sequence gives the preorder and inorder of the Binary tree T: **6**
Preorder: A B D G C E H I F
Inorder: D G B A H E I C F
Draw the diagram of the tree after every step. Also write down the postorder traversal of the tree from the final tree

OR iii. Explain different types of graph traversal used in data structures also explain different ways of graph representations explain each with the help of diagram. **6**

Q.4 i. Diagrammatically explain Red-Black tree with its properties. **3**

ii. Start with an empty AVL search tree and insert the following keys in order:20,10,5,30,40,3,4 draw figure depicting your tree immediately after each insertion and following the rebalancing rotation (if any). Label all nodes with their balance factor and identify the rotation type (if any) that is done. **7**

OR iii. Start with an empty splay tree and insert the following keys in order: 20,10,5,30,40,25,8 draw figure depicting your tree immediately after each insertion and following the rotation (if any). Label each rotation with rotation type. **7**

Q.5 i. What is the worst case and average case complexities of insertion sort, Heap sort, Merge sort and Quick sort. **4**

ii. Take 54 as pivot element and Sort 54, 26,93,14,31,44,55,20 using quick sort explain each step after comparison. **6**

OR iii. Write any two Characteristics of Insertion Sort and also Sort 12, 11, 13, 5, using insertion sort, write each step after every pass. **6**

Q.6 Attempt any two:

i. Write any two points for comparison of binary search and liner search. Also write down algorithm of binary searching. **5**

ii. What is linear probing? How it is different from quadratic probing? **5**

iii. What do you mean by chaining? Explain with its advantages. **5**

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Scheme of Marking

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Note: The Paper Setter should provide the answer wise splitting of the marks in the scheme below.

Q.1	i)	b) Queues	1
	ii)	c) Stack is the FIFO data structure	1
	iii)	b) v = e+1	1
	iv)	d)They occupy less size	1
	v)	c) Binary Heap Tree	1
	vi)	c) root	1
	vii)	d)quick sort (Selection sort)	1
	viii)	b) Divide and Conquer	1
	ix)	b) A function that computes the location of the key in the array	1
	x)	d)Item is the last element in the array or is not there at all	1
Q.2	i.	Algorithm (each step .5 marks)	2
OR	ii.	Limitations(with diagram) 4 mark, how it can be overcome (with diagram) 2 marks, algorithm 2 marks	8
	iii.	Types of linked list with diagram 6 marks Algorithm 2 marks	
Q.3	i.	One marks each definition with graph	4
OR	ii.	Tree step by step (each step 1 mark) total 5 marks Postorder traversal 1 mark	6
	iii.	graph traversal with diagram (3marks), graph representations with diagram (3marks),	6
Q.4	i.	Each property 1 marks	3
OR	ii.	Each insertion step have 1 mark	7
	iii.	Each insertion step have 1 mark	7
Q.5	i.	Each case 1 mark	4
OR	ii.	Each step 1 marks	6
	iii.	Each Characteristics 1 marks(2 marks),each pass 1 mark(4marks)	6
Q.6		Attempt any two:	
	i.	2 marks comparison ,algorithm Each step .5 mark	5
	ii.	Linear probing (2.5 marks) ,quadratic probing(2.5 marks)	5
	iii.	Chaining explanation(1 marks),advantages(4 marks)	5

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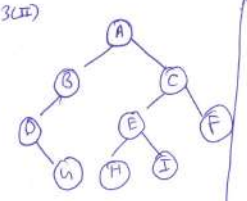
Q.3(ii)

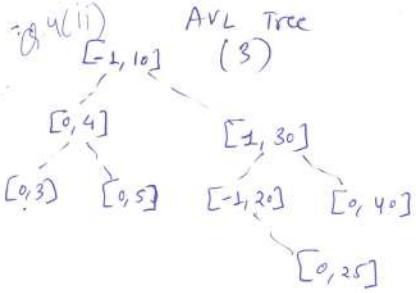


Postorder: GDBHIEFCA

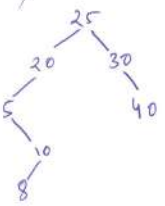
Q.3 ii) BFS: one node is selected and then all of the adjacent nodes are visited one by one, After completing all of the adj. vertices it moves further to link another vertex and checks adjacent vertex again

DFS: On starting vertex is given and when an adjacent vertex is found, it moves to that adj. vert. first and try to traverse in the same manner

Q.4(ii) AVL Tree (3)



Q.4(iii) Splay tree (43)



Q.5(i)

	W	Avg
I.S	n^2	n^2
H.S	$n \log n$	$n \log n$
M.S	$n \log n$	$n \log n$
Q.S	n^2	$n \log n$