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

Enrollment No.....

Faculty of Science

End Sem (Even) Examination May-2022

AI3CO36 / BC3CO36 / CT3CO36 / MI3CO36

Data Structures

Programme: B.Sc. Branch/Specialisation: AIML/CS/CTIS/MAIS

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. How is the 3rd element in an array accessed based on pointer notation? **1**

(a) *a + 2 (b) *(a + 2) (c) *(*a + 2) (d) &(a + 2)

ii. Which of the following data structure is linear type? **1**

(a) Strings (b) Lists (c) Queues (d) All of these

iii. What is the time complexity to count the number of elements in the linked list? **1**

(a) O(1) (b) O(n) (c) O(logn) (d) None of these

iv. Linked lists are not suitable for the implementation of- **1**

(a) Insertion sort (b) Radix Sort

(c) Polynomial manipulation (d) Binary Search

v. A parentheses checker program would be best implemented using- **1**

(a) List (b) Queue (c) Stack (d) All of these

vi. To perform level-order traversal on a binary tree, which of the following data structure will be required? **1**

(a) Hash table (b) Queue

(c) Binary search tree (d) Stack

vii. What is the best case time complexity for linear search? **1**

(a) O(nlogn) (b) O(logn) (c) O(n) (d) O(1)

viii. Which of the following is not an application of binary search? **1**

(a) To find the lower/upper bound in an ordered sequence

(b) Union of intervals

(c) Debugging

(d) To search in unordered list

ix. What is a full binary tree? **1**

(a) Each node has exactly zero or two children
(b) Each node has exactly two children
(c) All the leaves are at the same level
(d) Each node has exactly one or two children

x. What is the worst-case possible height of AVL tree? **1**

(a) $2\log_2 n$
(b) $1.44\log_2 n$
(c) Depends upon implementation
(d) $\theta(n)$

Q.2 i. What is persistent and non-persistent data structures? **2**

ii. How is an expression involving a subscript operator internally represented? Explain with an example. **3**

iii. Given two sorted one-dimensional arrays A and B of size m and n, respectively. Write a program to merge them into a single-sorted array C that contains every element from arrays A and B in ascending order. **5**

OR iv. What is the difference between tail and non-tail recursion? Write a function using tail recursion to calculate factorial of given number. **5**

Q.3 i. Compare a singly linked list and doubly linked list. **2**

ii. Assume that a Queue is represented using an array. Write an ADT function for ENQUEUE() and DEQUEUE() operation. **8**

OR iii. Write the pseudocode for an algorithm called 'copyStack' that copies the contents of one stack into another. The algorithm passes two stacks, the source stack and the destination stack. The order of the stacks must be identical. **8**

Q.4 i. Compare queue and doubly-ended-queue. **3**

ii. What is Tower of Hanoi problem? Write a program to solve Tower of Hanoi. **7**

OR iii. What is a Stack? Trace the steps involved in converting the given infix expression a + b * c + (d * e + f) * g to the postfix expression form using stack operations. **7**

Q.5 i. Define hashing, hash function and collision. **4**

ii. Explain Quick Sort algorithm with the help of an example. Mention the best-case and worst-case time complexity of Quick sort algorithm? **6**

OR iii. Write a program to sort elements using Bubble sort technique. **6**

Q.6 Attempt any two:

i. Illustrate the operation of Insert elements in MAX-HEAP. Assume that Heap is empty. **5**
Element list = {15, 13, 9, 5, 12, 8, 7, 4, 0, 6, 2, 1}

ii. What is the AVL tree? Write a function for Insert operation in AVL tree. **5**

iii. Give any two representations of graphs. What do you mean by in-degree and out-degree of a graph? **5**

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Marking Scheme
AI3CO36 / BC3CO36 / CT3CO36 / MI3CO36
Data Structures

Q.1	i.	How is the 3rd element in an array accessed based on pointer notation? (b) *(a + 2)		**1**
	ii.	Which of the following data structure is linear type? (d) All of these		**1**
	iii.	What is the time complexity to count the number of elements in the linked list? (b) O(n)		**1**
	iv.	Linked lists are not suitable for the implementation of- (d) Binary Search		**1**
	v.	A parentheses checker program would be best implemented using- (c) Stack		**1**
	vi.	To perform level-order traversal on a binary tree, which of the following data structure will be required? (b) Queue		**1**
	vii.	What is the best case time complexity for linear search? (d) O(1)		**1**
	viii.	Which of the following is not an application of binary search? (d) To search in unordered list		**1**
	ix.	What is a full binary tree? (a) Each node has exactly zero or two children		**1**
	x.	What is the worst-case possible height of AVL tree? (b) $1.44\log_2 n$		**1**
Q.2	i.	Persistent data structures Non-persistent data structures	1 mark 1 mark	**2**
	ii.	Subscript operator working Example	2 marks 1 mark	**3**
	iii.	Write a program to merge them into a single-sorted array C As per the explanation		**5**
OR	iv.	Difference between tail and non-tail recursion Program	2 marks 3 marks	**5**
Q.3	i.	Singly linked list Doubly linked list	1 mark 1 mark	**2**
	ii.	ADT function for ENQUEUE() ADT function for DEQUEUE() operation	4 marks 4 marks	**8**
OR	iii.	Pseudocode for stack design Pseudocode for data copy must be identical.	3 marks 5 markshe stacks	**8**
Q.4	i.	Queue Doubly-ended-queue Example	1 mark 1 mark 1 mark	**3**
	ii.	Tower of Hanoi problem Program to solve Tower of Hanoi	2 marks 5 marks	**7**
OR	iii.	Define Stack Diagram Stack operation for infix expression	1 mark 1 mark 5 marks	**7**
Q.5	i.	Definition of hashing Hash function Collision Diagram	1 mark 1 mark 1 mark 1 mark	**4**
	ii.	Define Quick Sort Explanation of algorithm Best-case and worst-case time complexity	1 mark 4 marks 1 mark	**6**
OR	iii.	Program to sort elements using Bubble sort technique. As per the explanation		**6**
Q.6		Attempt any two:		
	i.	Operation of Insert elements in MAX-HEAP. Assume that Heap is empty. Diagrams Explanation of diagram	 3 marks 2 marks	**5**
	ii.	AVL tree Function for Insert operation	2 marks 3 marks	**5**
	iii.	Any two representations of graphs Degree of a graph Outdegree of graph	3 marks 1 mark 1 marks	**5**

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