Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SCHOOL OF COMPUTER SCIENCE AND INFORMATION SYSTEMS
CONTINUOUS ASSESSMENT TEST - II
FALL SEMESTER 2024-2025

SLOT: F2+TF2

Programme Name & Branch	: B.Tech IT
Course Code and Course Name	: BITE201L Data Structures and Algorithms
Faculty Name(s)	: Dr. Ephzibah E.P, Dr. Lawanya Shri M, Dr. Kishore Raja P C
Class Number(s)	: VL2024250102874, VL2024250102868, VL2024250102884
Date of Examination	: 18.10.24
Exam Duration	: 90 minutes

Maximum Marks: 50

General instruction(s):

- Answer All Questions
- M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyze, 5 – Evaluate, 6 – Create)
- Course Outcomes
  2. Analyze and derive time and space complexity for algorithms designed.
  3. Illustrate various techniques for searching, sorting and hashing
  4. Write modular programs on nonlinear data structures and algorithms for solving engineering problems efficiently

Q. No	Question	M	CO	BL
1.	a. Find the worst case, average case and best case of time complexity for the following code	5	2	3

```
#include <stdio.h>
#include <stdlib.h>
typedef struct {
  int *arr;
  int capacity;
  int size;
} DynamicArray;
DynamicArray* createArray(int capacity) {
  DynamicArray* array = (DynamicArray*)malloc(sizeof(DynamicArray));
  array->arr = (int*)malloc(capacity * sizeof(int));
  array->capacity = capacity;
  array->size = 0;
  return array;
}
void insert(DynamicArray* array, int element) {
  if (array->size == array->capacity) {
    array->capacity *= 2;
    array->arr = (int*)realloc(array->arr, array->capacity * sizeof(int));
  }
  array->arr[array->size++] = element;
}
void delete(DynamicArray* array, int index) {
  if (index < 0 || index >= array->size) {
    printf("Invalid index\n");
    return;
  }
  for (int i = index; i < array->size - 1; i++) {
    array->arr[i] = array->arr[i + 1];
  }
  array->size--; }
void printArray(DynamicArray* array) {
  for (int i = 0; i < array->size; i++) {
    printf("%d ", array->arr[i]);
  }
  printf("\n");
}
int main() {
  DynamicArray* array = createArray(5);
  insert(array, 10);
  insert(array, 20);
  insert(array, 30);
  insert(array, 40);
  insert(array, 50);
  insert(array, 60);
  printArray(array);
  delete(array, 2);
  printArray(array);
  return 0;
}
```

	b. Arrange the following growth rates from slowest to fastest. $8n^2$, $\log_4 n$, $n!$, 3^n , $20n$, 2 , $\log_2 n$, $n^{6/8}$	5	2	3
2.	Given the recurrence relation expression T(n) = 2T(n/2) + n. Identify the suitable recursive algorithm and find the time complexity using substitution method and recursive tree method.	10	2	4
3.	A healthcare provider is developing a medical records management system to handle patient data efficiently. The system needs to sort patient records by various attributes, such as patient ID, name, and appointment date. With a growing number of patients, the dataset is expected to reach tens of thousands of records. The primary requirement is to sort patient records by appointment date for scheduling and reporting purposes. The system must also support sorting by patient ID and name as needed. The development team wants to choose a stable sorting technique, making it suitable for larger datasets and the time complexity is less than ~~linear~~ time. Identify and write the suitable sorting algorithm, example and its time complexity. [Consider only patientID as input]	10	3	3
4.	A public library is developing a cataloging system to manage and sort its collection of books. The system will allow librarians to sort books by bookid, title, author, and publication year. The library expects to handle a dataset of around 500 books, with occasional updates as new books are added. The primary requirement is to sort the book records primarily by title, and the system should also efficiently handle cases where books are added to the catalog in a nearly sorted manner. The development team considers Insertion Sort due to its advantages in specific contexts, particularly	10	3	4

Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SCHOOL OF COMPUTER SCIENCE AND INFORMATION SYSTEMS
CONTINUOUS ASSESSMENT TEST - II
FALL SEMESTER 2024-2025

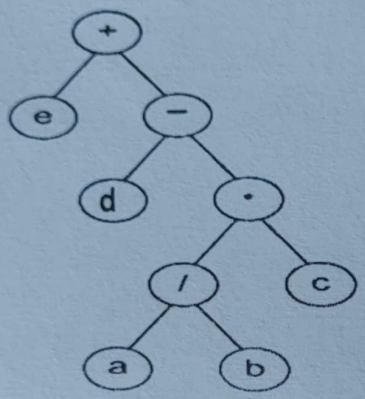
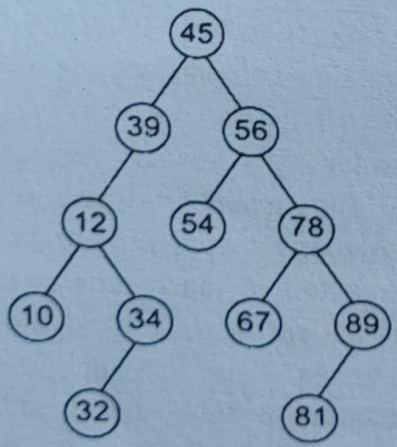
SLOT: F2+TF2

VIT
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

REG.NO.:

SCHOOL OF COMPUTER SCIENCE AND INFORMATION SYSTEMS
CONTINUOUS ASSESSMENT TEST - II
FALL SEMESTER 2024-2025

SLOT: F2+TF2

	for smaller datasets or nearly sorted data. Implement Insertion sort (only sorting function and display function) using linked list. [Consider only bookid as input]			
5.	a. For the expression tree given below, do the following: i. Extract the infix expression it represents ii. Find the corresponding prefix and postfix expressions iii. Evaluate the infix expression, given a = 30, b = 10, c = 2, d = 30, e = 10  	5	4	3
	b. Consider the binary search tree given below. Now do the following operations: i. Find the result of in-order, pre-order, and post-order traversals. ii. Show the deletion of the root node iii. Insert 11, 22, 33, 44, 55, 66, and 77 in the tree Write an algorithm for in-order , pre-order and post-order traversals  	5	4	3