REG.NO.: 25MCA0081

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

SCHOOL OF COMPUTER SCIENCE ENGINEERING AND INFORMATION SYSTEMS
CONTINUOUS ASSESSMENT TEST - I
FALL SEMESTER 2025-2026

SLOT: D2+TD2

Programme Name & Branch : MCA
Course Code and Course Name : PAMCA501 - Data Structures and Algorithms
Faculty Name(s) : Dr.E.P.Ephzibah & Dr. Ramalingam M
Class Number(s) : 6016, 6047
Date of Examination : 20-8-2025
Exam Duration : 90 minutes
Maximum Marks: 50

General instruction(s):

- M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)
- Course Outcomes
  1. Analyse time and space complexity of algorithms using asymptotic notation.
  2. Compare searching, sorting, and nonlinear data structure techniques.

Q. No	Answer all the questions	M	CO	BL
1.	You are designing a call centre ticketing system for a telecom company. Every incoming call is logged as a support ticket and added to a circular queue. The queue has a fixed size due to limited memory, and tickets are processed in a first-come, first-serve manner. However, during high-traffic hours, the system experiences queue overflow and underflow conditions. Additionally, there's a need to prioritize premium customers during such periods. Design and explain the enqueue and dequeue operations in a circular queue, ensuring proper handling of overflow and underflow conditions. Modify the queue logic to incorporate a priority mechanism where premium customer tickets can be inserted just after the front, without disrupting the queue's circular nature.	5 5	1	3
2.	The recursive function to compute the n^{th} Fibonacci number is defined as: F(0)=0, F(1)=1, F(n)=F(n−1)+F(n−2), for n>1 Implement a recursive algorithm and analyse the time complexity of your solution using recurrence relations and derive the final time complexity using the substitution method.	10	1	2
3.	You are given a list of keys: [23, 43, 13, 27, 87, 65, 34, 76]. Consider a hash table with size 10 and the hash function, h(k) = k % 10. Write the code snippet/ algorithm for the following methods and display the final contents of the table: a) **Linear Probing**: Insert the keys into the hash table using linear probing. b) **Quadratic Probing**: Insert the keys using quadratic probing: on collision, use i^2 offset for probing. c) **Chaining**: Implement the hash table using chaining with lists to handle collisions.	10	2	3
4.	You are designing a system for a robotic arm that places books on a shelf. Books are picked up one at a time in the order they arrive and must be placed on the shelf such that the shelf always maintains books in increasing order of	10	2	3

	height from left to right. If a book is taller than all the books currently on the shelf, it's placed at the end. Otherwise, it is inserted at the correct position to maintain the increasing order. This shifting process must be repeated for each incoming book. Identify a suitable sorting algorithm for the given scenario and write a program to simulate this process. Show the status of the given collection for each iteration: 98, 25,43,78,55,22,18,102,39,40			
5.	A theme park ride uses a singly linked list to manage the order of visitors waiting for their turn. Each node contains: Ticket Number (integer), Visitor Name (string). The ride works in the following way: **Insertion**: At the end (new visitor joins the queue) and At the beginning (VIP visitor skips the line). **Deletion**: Remove a visitor by Ticket Number (if they leave the queue). **Traversal**: Display the queue in the order visitors will take the ride. Write a program using a singly circular linked list to simulate the ride queue management.	10	1	2

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