


Final Assessment Test – April 2025

Course: ICSE102L - Structured and Object Oriented Programming

Slot: F2

Class NBR(s): 4147 / 4152 / 4157 / 4161

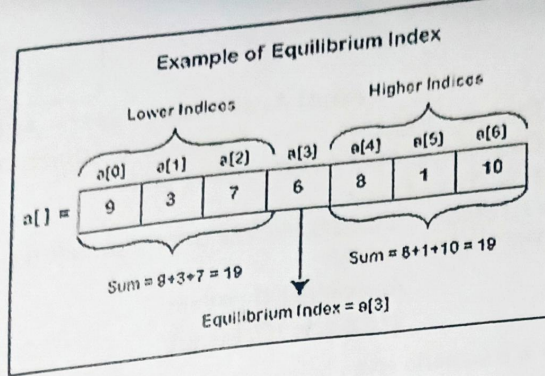
Max. Marks: 100

Time: Three Hours

- KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
- DON'T WRITE ANYTHING ON THE QUESTION PAPER

Answer ALL Questions
 (10 X 10 = 100 Marks)

- Write a C program for the scenario given below:
 A vending machine allows a user to purchase multiple items in a single transaction. The user can enter multiple item numbers (1-5) one by one. The machine should keep a running total of the bill. When the user enters 0 the machine displays the total amount and prompts for payment. If the amount paid is less than the total, display "Insufficient amount"; otherwise, show the change to be returned.
 The menu is as follows:
 1. Chips - ₹20 2. Chocolate - ₹30
 3. Juice - ₹40 4. Biscuits - ₹25
 5. Ice Cream - ₹50
Sample I/P & O/P
 Enter item number (1-5) or 0 to finish: 2
 You selected Chocolate - ₹30
 Enter item number (1-5) or 0 to finish: 3
 You selected Juice - ₹40
 Enter item number (1-5) or 0 to finish: 0
 Total amount: ₹70
 Enter amount: 100
 Change to be returned: ₹30
Sample I/P & O/P
 Enter item number (1-5) or 0 to finish: 5
 You selected Ice Cream - ₹50
 Enter item number (1-5) or 0 to finish: 0
 Total amount: ₹50
 Enter amount: 40
 Insufficient amount.
- A company is evaluating employees' productivity over a week, with performance scores recorded in an array where each index corresponds to a specific day (0 = Monday, 1 = Tuesday, etc.). An equilibrium index is a position in the array where the sum of all elements before it is equal to the sum of all elements after it. The company aims to identify such indices to determine when the workload is evenly distributed. Write a C program that accepts an array of productivity scores and finds all equilibrium indices.



Sample Input & Output:

Input: Enter number of days: 7
 Enter productivity scores: 9 3 7 6 8 1 10
 Output: Equilibrium index found at position: 3

Sample Input & Output:

Input: Enter number of days: 7
 Enter productivity scores: 9 0 1 5 6 3 2 1
 Output: No Equilibrium index found

3. Read two integers N1 and N2 and check whether N1 and N2 are amicable numbers with the help of pointers in a C program. [Hint: Two numbers are called as Amicable Numbers, if the sum of the proper divisors of one number is equal to the other number and vice versa]

Sample I/P : N1 = 220, N2 = 284

O/P: N1 and N2 are amicable numbers.

Sample I/P : N1 = 22, N2 = 150.

O/P: N1 and N2 are not amicable numbers.

4. Read an array of 'N' integers from the user. Write a C program that uses a structure to store the array of numbers and sorts them in ascending order.
5. Explore the basic concepts and benefits of inline function with your own illustration.
6. Write a C++ program using multi-level inheritance to store and display student details, marks, and results. The base class Student should store the student's roll number and name, with functions to input and display these details. The intermediate class Exam, inherited from Student, should store marks for three subjects and provide functions to input and display the marks. The derived class Result, inherited from Exam, should calculate and display the total and percentage. The program should accept the number of students, input their details and marks, and display the results.
7. In a physics simulation program, you're required to model electric fields using complex numbers. Each complex number represents a point in the complex plane, where the real part indicates the horizontal component of the electric field, and the imaginary part indicates the vertical component. To facilitate this simulation, implement a Complex class in C++ that supports operator overloading for addition and subtraction, operations on complex numbers.

Input:

$$c1 = 3 + 4i$$

$$c2 = 1 + 2i$$

Output:

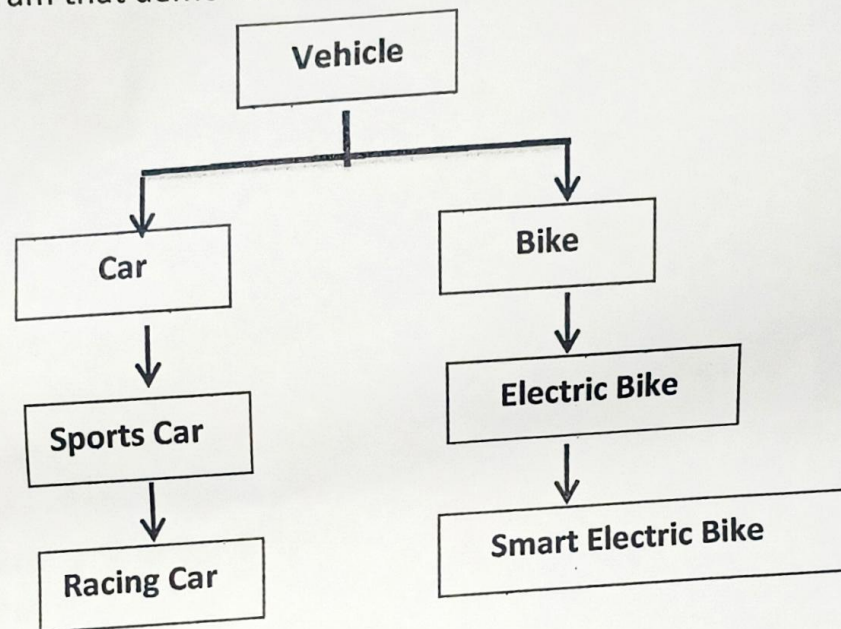
$$\text{Sum: } 4 + 6i$$

$$\text{Difference: } 2 + 2i$$

8. Write a C++ program that implements a generic function using templates to find the maximum of three values. The function should work for different data types, including integers, floating-point numbers and characters.
- 9.a) Write a C++ program that demonstrates the practical use of friend functions which simulates a simple banking system where a Bank Account class manages account details, and a friend function is used to display these details without exposing the private data.

OR

- 9.b) Design a C++ program that demonstrates the following inheritance:



- 10.a) Describe the concept of virtual functions with an example program.

OR

- 10.b) Elucidate the concepts behind abstract classes and standard template library with suitable illustrations.