

Name of the Student.. *Rahul Agarwal*

Scholar Number.. *2311201268*

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY BHOPAL**  
**DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING**

Course: B.Tech.

Semester: III

Branch: CSE

Subject Code: CSE 213

Subject Name: Principles of Programming Languages

Maximum Marks: 50

Duration: 3 Hours

Date: 28/11/2024

Time: 9:30 AM to 12:30 PM

**Note:** Attempt all the questions. Answers should be brief and to the point. Make suitable assumptions wherever necessary and clearly state the same.

Q. No.	Questions	Marks	COs
1.	<p>(A) What are the fundamental features of Functional programming languages and how they differ to other programming paradigms. Give proper example of these features.</p> <p>(B) Why readability of a programming language became its most important evaluation criterion and what are the features of programming languages that affect its readability?</p>	5+5	CO1
2.	<p>(A) How storage durations associated with any variable affect its behavior in program. Give examples of C++ programming language storage duration?</p> <p>(B) Write a C++ program to demonstrate the Diamond Problem in Inheritance hierarchy. Create a base class A with a method display(), and two derived classes B and C that inherit from A. Finally, create a class D that inherits from both B and C. Modify your program to resolve the ambiguity in accessing the display() method using virtual inheritance. Explain how virtual inheritance prevents the diamond problem.</p>	5+5	CO1 CO2
3.	<p>(A) Write a C++ program which is having a class BOX. This class is having three private data members named as length, height and width. Create five objects of the class BOX with following characteristics:</p> <ol style="list-style-type: none"><li>1) Object one and two are of size (1, 2, 3) and (3, 5, 7) respectively.</li><li>2) Object three size is sum of the size of object one and object two.</li><li>3) Object four is initialized by object three.</li><li>3) Object five size is 10 times the size of object four.</li></ol> <p>define constructor, destructor and function to find the volume of the objects. Define all required functions of this program. Display the volume of object five.</p> <p>(B) Write a C++ code to demonstrate the memory leak caused by not using a virtual destructor. Modify the example to include a virtual destructor and explain how it resolves the problem.</p>	5+5	CO2 CO2
4.	<p>(A) Write a C++ program to manage customer information for a mobile service provider. Define a class Customer with the following data members: Customer_name, DOB , Address, Service_plan_no , Fee . Define a method to add a new customer, with an option to join with or without a service plan. Fee calculation logic based on the service plan. A mechanism to track the total number of customers and ensure that every 100th customer gets a fee waiver. In</p>	5+5	CO2 CO2

	<p>Main add multiple customers with different scenarios (with and without service plans), and Display the details of all customers, including any fee waivers applied.</p> <p><b>(B)</b> How race condition creates problems in concurrent programming and how we can avoid it in C++ program give an example of it. Suppose we have three arrays, first is A1 of 8000000 elements, second is A2 of 5000000 elements and third A3 of 2000000 elements. Write a multithreaded C++ program to find the minimum element of A1 and maximum element of A2. Add minimum of A1 and maximum of A2 to each element of A3.</p>		
5.	<p><b>(A)</b> Consider the code segment mentioned below:</p> <pre>try { function_A();     try {         function_B();     } catch (error1) { Cout&lt;&lt; "Error1" ; }     catch (error2) { Cout&lt;&lt; "Error2" ; }     function_C();     function_D(); } catch (error3) { Cout&lt;&lt; "Error3" ; } catch (error4) { Cout&lt;&lt; "Error4" ; }</pre> <p>Step-by-step, explain how this code segment will execute if:</p> <ol style="list-style-type: none"> <li>function_A() throws an exception of type error4.</li> <li>function_B() throws an exception of type error2.</li> <li>function_B() throws an exception of type error3.</li> <li>function_C() throws an exception of type error1.</li> </ol> <p><b>(B)</b> Consider the Prolog code mentioned below:</p> <pre>male(john). male(tom). male(bob). female(mary). female(alice). female(susan). parent(john, mary). parent(john, tom). parent(mary, alice). parent(mary, bob). parent(susan, mary). parent(susan, tom). sibling(X, Y) :- parent(P, X), parent(P, Y), X \= Y. grandparent(GP, GC) :- parent(GP, P), parent(P, GC).</pre> <p>Step by step explain how <b>backtracking</b> works to find the result for queries:</p> <pre>?- sibling(mary, S). ?- grandparent(GP, alice).</pre>	5+5	CO3

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