Assignment-3

1.What is an object in C++?

Explain the concept of encapsulation with an example.

Ans-In C++, an object is an instance of a class. A class is like a blueprint, while an object is a specific realization of that blueprint. Objects have attributes (data members) and behaviors (member functions) that define their properties and actions.

cpp

#include <iostream>

using namespace std;// Define a class

class Car {

public:

string brand;

int speed;

// Member function

void showInfo() {

cout << "Brand: " << brand << ", Speed: " << speed << " km/h" << endl;

}

};

int main() { // Create an object of Car class

Car myCar; // Assign values to object properties

myCar.speed = 120;

// Call member function

myCar.showInfo();

return 0;

}

Output:

Brand: Toyota, Speed: 120 km/h

2.What is a class in C++ and how does it differ from an object?

Ans-In C++, a class is a blueprint or template for creating objects, defining their data members (attributes) and member functions (methods), while an object is a specific instance or realization of that class.

3.Explain the concept of encapsulation with an example.

Ans-Encapsulation is one of the fundamental principles of Object-Oriented Programming (OOP). It refers to the bundling of data (variables) and methods (functions) that operate on that data into a single unit, typically a class. It also involves restricting direct access to some of the object's components, which helps prevent unintended interference and enhances security.

Example:-

Cpp

#include<iostream>

Using namespace std;

Class Student{

Private:

Int age;

Public:

Void setage(int a){

Age=a;

}

Int getage(){

Return age;}

};

Int main(){

Student s;

s.setage(18);

cout<<s.getage();//output:18

return 0;

}

4.How do you define a class in C++?

Ans-In C++, a **class** is defined using the class keyword. A class is a blueprint for creating objects and encapsulates data members (variables) and member functions (methods) that operate on the data.

#include <iostream>

using namespace std;

class MyClass { // Class definition

public: // Access specifier

int num; // Data member (variable)

void display() { // Member function

cout << "Number: " << num << endl; }

};

int main() {

MyClass obj; // Creating an object of MyClass

obj.num = 10; // Assigning value

obj.display(); // Calling the member function

return 0;}

5.Describe the syntax for creating an object of a class.

Ans-An **object** is an instance of a class. Once a class is defined, we can create objects using the following syntax:

Example-

#include <iostream>

using namespace std;

class Car { // Class definition

public:

string brand;

int year;

void display() { // Member function

cout << "Brand: " << brand << ", Year: " << year << endl;

}

};

int main() {

Car myCar; // Creating an object of the Car class

// Assigning values to object members

myCar.brand = "Toyota";

myCar.year = 2022;

// Calling a member function

myCar.display();

return 0;

}

6.What are private members in a class and how are they accessed?

Ans-**Private members** in a class are variables or methods that cannot be accessed directly from outside the class. They can only be accessed within the class itself.

class ClassName {

private:

int privateVar; // Private data member

void privateMethod() { // Private member function

// Code here

}

};

How to Access Private Members?

Since private members cannot be accessed directly outside the class, they must be accessed using public member functions (getter/setter methods).

#include <iostream>

using namespace std;

class BankAccount {

private:

double balance; // Private data member

public:

// Constructor to initialize balance

BankAccount(double initialBalance) {

balance = initialBalance; } // Public method to deposit money

void deposit(double amount) {

balance += amount;

cout << "Deposited: $" << amount << ", New Balance: $" << balance << endl;

}

// Public method to get the balance (Getter function)

double getBalance() {

return balance;

}

};

int main() {

BankAccount myAccount(1000); // Creating an object

myAccount.deposit(500); // Depositing money

cout << "Final Balance: $" << myAccount.getBalance() << endl; // Accessing private data via getter

// Direct access to private member is not allowed:

// myAccount.balance = 2000; // Error: balance is private

return 0;

}

7.What are public members in a class and how are they accessed?

Ans-**Public members** of a class are variables (data members) or methods (member functions) that can be accessed from outside the class using an object.

class ClassName {

public:

int publicVar; // Public data member

void publicMethod() { // Public member function

// Code here

}

};

Public members are accessed using the **dot (.) operator** with an object of the class.

**Example: Accessing Public Members**

#include <iostream>

using namespace std;

class Car {

public:

string brand; // Public data member

int year;

// Public member function

void display() {

cout << "Brand: " << brand << ", Year: " << year << endl;

}

};

int main() {

Car myCar; // Creating an object

// Accessing public data members

myCar.brand = "Toyota";

myCar.year = 2022;

// Calling a public member function

myCar.display();

return 0;

}

8**.** Explain the significance of access specifiers in a class**.**

**Access Specifiers in a Class (C++)**

Access specifiers in C++ determine the visibility and accessibility of class members (variables and functions). They help in data hiding,security, and encapsulation.

**Types of Access Specifiers:**

| **Access Specifier** | **Accessibility** | **Usage** |
| --- | --- | --- |
| **public** | Accessible from anywhere (inside & outside the class). | Used for functions or data that should be accessible freely. |
| **private** | Accessible only within the class. | Used to protect data from direct modification. |
| **protected** | Accessible within the class and its derived (child) classes. | Used in inheritance to allow controlled access to derived classes. |

9. Provide an example of a class with both private and public members.

Ans-Example-

#include <iostream>

using namespace std;

class BankAccount {

private:

double balance; // Private member: Cannot be accessed directly

public:

string accountHolder; // Public member: Can be accessed directly

// Constructor to initialize balance

BankAccount(string name, double initialBalance) {

accountHolder = name;

balance = initialBalance;

}

// Public method to deposit money (modifies private data)

void deposit(double amount) {

if (amount > 0) {

balance += amount;

cout << "Deposited: $" << amount << ", New Balance: $" << balance << endl;

} else {

cout << "Deposit amount must be positive!" << endl;

}

}

// Public method to withdraw money (modifies private data)

void withdraw(double amount) {

if (amount > 0 && amount <= balance) {

balance -= amount;

cout << "Withdrawn: $" << amount << ", Remaining Balance: $" << balance << endl;

} else {

cout << "Insufficient funds or invalid amount!" << endl;

}

}

// Public method to get balance (access private data)

double getBalance() {

return balance;

}

};

int main() {

// Creating an object of BankAccount

BankAccount myAccount("Pooja", 5000);

// Accessing public member directly

cout << "Account Holder: " << myAccount.accountHolder << endl;

// Accessing private member through public methods

myAccount.deposit(1500);

myAccount.withdraw(2000);

// Using getter method to access private balance

cout << "Final Balance: $" << myAccount.getBalance() << endl; return 0;

}

10. How does data hiding work in C++?

Ans-Data Hiding means restricting direct access to a class’s data members to protect them from accidental modification.

Private members (variables/functions) cannot be accessed directly from outside the class.

They can only be accessed using public functions (getter & setter methods).

11. What is a static data member in C++?

Ans-A static data member in C++ is a variable that is shared amongall objects of a class. It is declared using the static keyword inside the class.

-Belongs to the class, not to individual objects.  
 -Memory is allocated only once, not separately for each object.  
 -All objects share the same value of the static variable.

#include <iostream>

using namespace std;

class Student {

private:

string name;

int rollNumber;

public:

static int totalStudents; // Static data member

// Constructor to initialize student details

Student(string n, int roll) {

name = n;

rollNumber = roll;

totalStudents++; // Increment static variable

}

// Function to display student details

void display() {

cout << "Name: " << name << ", Roll No: " << rollNumber << endl;

}

};

// Initialize static data member outside the class

int Student::totalStudents = 0;

int main() {

Student s1("Pooja", 101);

Student s2("trapti", 102);

Student s3("sansu", 103);

s1.display();

s2.display();

s3.display(); // Accessing static member using class name

cout << "Total Students: " << Student::totalStudents << endl;

return 0;}

12.How do you declare and initialize a static data member?

Ans-A static data member is a variable that belongs to the class, notto individual objects. It is shared among all objects of the class.

#include <iostream>

using namespace std;

class Counter {

public:

static int count; // Declaration of static member

Counter() {

count++; // Increment count when an object is created

}

};

// Initialization of static data member outside the class

int Counter::count = 0;

int main() {

Counter c1, c2, c3; // Creating three objects

// Accessing static variable using class name

cout << "Total Objects Created: " << Counter::count << endl;

return 0;

}

13.What is a static function member in C++?

Ans-A static member function in C++ is a function that belongs to the class, not to any specific object. It can only access static datamembers and can be called without creating an object.

#include <iostream>

using namespace std;

class Counter {

private:

static int count; // Static data member

public:

// Constructor to increment count

Counter() {

count++; }

// Static function to get count

static int getCount() {

return count;

}

};

// Initialize static data member outside the class

int Counter::count = 0;

int main() {

Counter c1, c2, c3; // Creating objects

// Accessing static function without an object

cout << "Total Objects Created: " << Counter::getCount() << endl; return 0;s

}

14. . How do static function members differ from regular function members?

Ans-

| **Feature** | **Static Member Function** | **Regular function member** |
| --- | --- | --- |
| Belongs to | Class (shared among all objects) | Individual objects |
| Access Method | Can be called using ClassName::FunctionName() | Needs an object to be called (obj.FunctionName()) |
| Access to Non-Static Members | Cannot access non-static variables or functions | Can access both static and non-static members |
| Access to Static Members | Can access only static data members | Can access static and non-static members |
| Usage | Used for operations related to the class as a whole (e.g., counting objects) | Used for object-specific operations (e.g., modifying instance variables) |

15. Provide an example of a class with static data and function members.

#include <iostream>

using namespace std;

class Counter {

private:

static int count; // Static data member (shared by all objects)

public:

// Constructor increments count when an object is created

Counter() {

count++;

}

// Static function to get the count value

static int getCount() {

return count;

}

};

// Initialize static data member outside the class

int Counter::count = 0;

int main() {

Counter obj1, obj2, obj3; // Creating objects

// Accessing static function without an object

cout << "Total Objects Created: " << Counter::getCount() << endl;

return 0;

}

16. What is a constructor in C++ and why is it important?

Ans-A constructor in C++ is a special member function of a class that is automatically called when an object of that class is created. Its main purpose is to initialize the object — that means it sets up the initial values for the data members of the class.

Importance of a Constructor:

1. Automatic Initialization – Helps to initialize objects when they are created.
2. Code Reusability – You can create multiple constructors using constructor overloading to initialize in different ways.
3. Avoids Errors – Ensures that objects start in a valid state (no garbage values).

17. Explain the different types of constructors in C++.

- In C++, there are **three main types of constructors**, each with a specific purpose. Let’s go through them with simple examples to make them easy to understand.

1.Default Constructor

A constructor that takes no parameters.

class Student {

int roll;

public:

Student() { // Default constructor

roll = 0;

}

void display() {

cout << "Roll: " << roll << endl;

}

};

2.Parameterized Constructor

A constructor that takes arguments to initialize the object with custom values.

class Student {

int roll;

public:

Student(int r) { // Parameterized constructor

roll = r;

} void display() {

cout << "Roll: " << roll << endl;

}

};

3.Copy Constructor

A constructor that copies data from another object of the same class.

class Student {

int roll;

public:

Student(int r) {

roll = r;

} Student(const Student &s) { // Copy constructor

roll = s.roll;

}

void display() {

cout << "Roll: " << roll << endl;

}

};

Int main(){

Student s1(101);

Student s2 = s1; // Copy constructor called

s2.display(); // Output: Roll: 101

}

**Constructor Overloading**

You can define **multiple constructors** with different parameter lists in the same class.

class Student {

public:

Student() {

cout << "Default constructor\n";

}

Student(int r) {

cout << "Parameterized constructor\n";

}

};

18. What is a default constructor and when is it used?

Ans-A default constructor is a constructor in C++ that takes noparameters.  
It is either defined by the programmer or automatically provided by the compiler if no constructor is defined in the class.

class MyClass {

public:

MyClass() { // Default constructor

// Initialization code

}

};

Default ConstructorUsed

1. When you create an object without passing any arguments:
2. To initialize objects with default values:
3. When you create an array of objects:

19. How do parameterized constructors work?

Ans-A parameterized constructor is a constructor that accepts arguments.  
It allows you to initialize objects with specific values at the time of creation.

20. What is a copy constructor and what is its purpose?

A copy constructor is a special constructor in C++ that creates a newobject by copying an existing object of the same class.

**Purpose of Copy Constructor:**

1. To copy an object’s data into another object.
2. Used when:
   * You pass an object by value to a function.
   * A function returns an object by value.
   * You initialize one object from another.

21. Explain the concept of constructor overloading.

Ans-Constructor overloading means creating multiple constructors in the same class with different parameter lists.

Based on the number or type of arguments, the correct constructor is chosen when an object is created.

22. How does a constructor initializer list work?

Ans-A constructor initializer list is a way to initialize data members directly when a constructor is called, before the body of the constructor runs.

It's written after the constructor's parameter list, using a colon.

23. What is a destructor in C++ and what is its purpose?

Ans-A destructor is a special member function of a class that is automatically called when an object goes out of scope or is deleted.

Its main purpose is to release resources (like memory, files, etc.) that were acquired by the object during its lifetime.

#include <iostream>

using namespace std;

class Student {

public:

Student() {

cout << "Constructor called!" << endl;

}

~Student() {

cout << "Destructor called!" << endl;

}

};

int main() {

Student s1; // Constructor is called here

// When main() ends, destructor is called automatically

return 0;

}

Purpose of a Destructor:

1. Free dynamically allocated memory
2. Close file handles or network connections
3. Clean up resources to avoid memory leaks

24. How is a destructor declared and defined?

Ans-In C++, a destructor is a special member function that is automatically invoked when an object goes out of scope or is explicitly deleted. It is used to free resources that were allocated to the object (like memory, file handles, etc.).

25. What happens if a destructor is not explicitly defined in a class?

Ans-In C++, a destructor is a special member function that is automatically called when an object goes out of scope or is explicitly deleted. It is used to release resources (like memory, file handles, etc.).

26. Explain the concept of automatic and dynamic storage duration in relation to destructors.

Ans-

| **Feature** | **Automatic Storage** | **Dynamic Storage** |
| --- | --- | --- |
| Allocation method | Stack (auto) | Heap (new) |
| Lifetime | Until end of scope | Until delete is called |
| Destructor call | Automatic | Must be manual via delete |
| Risk | Low | Memory leak if not deleted |
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|  |  |  |  |
|  |  |  |  |

27. How do destructors differ from constructors?

Ans-

28. What is operator overloading in C++ and why is it useful?

Operator overloading means giving special meaning to an existing operator (like +, -, \*, etc.) for user-defined types (like classes or structs).

It allows you to use operators with objects, just like you use them with basic data.

Why is it Useful?

* Makes code more readable and intuitive.
* Lets objects behave like basic types.
* Helps in performing operations on complex data (like complex numbers, fractions, vectors, etc.).

29. Describe the syntax for overloading an operator.

* Ans-operator is the keyword.
* op is the operator you want to overload (+, -, \*, ==, etc.).
* The function defines what the operator should do when used with your class.

Syntax-

30. Which operators can and cannot be overloaded in C++?

Ans-Operators that can be Overloaded**:**

These are commonly overloaded for custom behavior:

| **Operator** | **Meaning** |
| --- | --- |
| +, -, \*, /, % | Arithmetic |
| ==, !=, <, >, <=, >= | Comparison |
| =, +=, -=, \*= etc. | Assignment |
| [] | Array subscript |
| () | Function call |
| -> | Member access via pointer |
| <<, >> | Stream insertion/extraction (used in cout, cin) |
| &, ` | , ^, ~, !` |
| ++, -- | Increment/decrement |
| new, delete, new[], delete[] | Memory management |
| ->\*, .\* | Pointer to member |

Operators that cannot be overloaded**:**

| **Operator** | **Reason** |
| --- | --- |
| . (dot operator) | Direct member access – can't be changed |
| .\* (pointer-to-member) | Partially overloaded, but not in a useful way |
| :: (scope resolution) | Used by compiler to find scope |
| sizeof | Evaluated at compile time |
| typeid | Used for RTTI (Run-Time Type Information) |
| ?: (ternary conditional) | Fixed structure |
| const\_cast, static\_cast, dynamic\_cast, reinterpret\_cast | Cast operators |
| #, ## | Preprocessor operators – not part of C++ itself |

31. Provide an example of overloading the "+" operator for a custom class.

Ans-#include <iostream>

using namespace std;

class Point {

private:

int x, y;

public:

// Constructor

Point(int x = 0, int y = 0) {

this->x = x;

this->y = y;

}

// Overload '+' operator

Point operator + (const Point& other) {

Point result;

result.x = this->x + other.x;

result.y = this->y + other.y;

return result;

}

// Function to display the point

void display() {

cout << "(" << x << ", " << y << ")" << endl;

}

};

int main() {

Point p1(2, 3);

Point p2(4, 5);

Point p3 = p1 + p2; // using overloaded '+'

cout << "Result of p1 + p2 is: ";

p3.display(); // Output: (6, 8)

return 0;

}

31. Provide an example of overloading the "+" operator for a custom class.

Ans-

32. Explain the concept of friend functions in the context of operator overloading.

Ans-A friend function is a function that is not a member of a class but still has access to its private and protected members.

We declare a friend function using the keyword friend inside the class.

When we want to overload an operator and have:

* The left operand NOT be a member of the class (e.g., int + MyClass)
* Or we want to access private data of the class from a non-member function

Then we can use a friend function.

33.What is a friend function in C++ and how is it declared?

Ans-A friend function is a non-member function that is given access to the private and protected members of a class.

Even though it's not part of the class, the class gives it "friend access" so it can peek inside and interact with private data.

How is it Declared?

It is declared inside the class using the friend keyword.

cpp

CopyEdit

class ClassName {

friend ReturnType FunctionName(Arguments);};

34. How do friend functions differ from member functions?

Ans-

| Feature | Friend Function | Member Function |
| --- | --- | --- |
| Belongs to class? | No (it's not a member) | Yes |
| Declared using friend? | Yes | No |
| Access to private members? | Yes (via friendship) | Yes (automatically) |
| Called using object? | Not necessarily (can be called like a regular function) | Yes (called using the object or pointer) |
| Has this pointer? | No (not inside the class, so no this) | Yes (points to the current object) |
| Can access only its class? | Can be friend to multiple classes | Typically only works with the class it's defined in |
| Syntax for access | Needs object reference | Can directly access with this-> |

35. Explain the benefits and potential drawbacks of using friend functions.

Ans-

| Benefit | Description |
| --- | --- |
| Access to Private Data | Friend functions can access private andprotected members, even though they are not part of the class. |
| Helps in OperatorOverloading | Especially useful when overloading binary operators where the left operand isn't a class object. |
| Inter-Class Communication | A friend function can be a friend to multiple classes, making it easier to work with two or more classes together. |
| Better Readability in Some Cases | Keeping functions outside the class can make code cleaner and more modular, especially when the function doesn't logically belong as a member. |
|  |  |

|  |  |  |
| --- | --- | --- |
|  |  |  |
|  |  |

33. What is a friend function in C++ and how is it declared? Top of Form

Ans-A friend function in C++ is a function that is not a member of a class but is granted access to the class's private and protected members. It is useful when you want a function (or another class) to access private data of a class without being a member of it.

34. How do friend functions differ from member functions?

Ans- **Friend Function vs Member Function**

| **Feature** | **Friend Function** | **Member Function** |
| --- | --- | --- |
| **Belongs to Class?** | Not a member of the class | Yes, it's part of the class |
| **Declared with friend?** | Yes, needs friend keyword inside the class | No need for friend keyword |
| **Access to Private Members** | Yes (only if declared as friend) | Yes (automatically) |
| **Uses this pointer?** | No this pointer | Has a this pointer |
| **Calling Style** | Like a normal function: show(obj); | Using object: obj.show(); |
| **Inheritance** | Not inherited by derived classes | Can be inherited |
| **Defined Outside Class?** | Yes | Can be (or inside) |

35. Explain the benefits and potential drawbacks of using friend functions.

Ans- **Benefits of Friend Functions**

1. **Access to Private Members**
   * Friend functions can access the private and protected data of a class.
   * Useful when two or more classes need to share internal details.
2. **Operator Overloading**
   * Ideal for overloading operators like <<, >>, +, etc., especially when the left-hand operand is not an object of the class.
3. **Better Encapsulation Across Classes**
   * When two classes are tightly related, friend functions help coordinate data access without making everything public.
4. **Flexibility**
   * Friend functions don’t need to be called on an object.
   * Makes some operations easier (e.g., comparing two different objects).

**Drawbacks of Friend Functions**

1. **Breaks Encapsulation**
   * Since it can access private members, it violates the concept of **data hiding** in OOP.
2. **Tight Coupling**
   * If overused, friend functions can tightly couple unrelated classes or functions, making code harder to maintain.
3. **Not Inherited**
   * Friend functions are **not inherited** by derived classes.
   * You must declare them again if needed in child classes.
4. **No this Pointer**
   * Cannot access the object implicitly like member functions — the object must be passed explicitly.

36. What is inheritance in C++ and why is it important?

Ans-Inheritance is a feature that allows a class (child/derived) to acquire the properties and behaviors (methods and variables) of another class (parent/base).

It helps create a hierarchy and promotes code reuse.

class Animal { // Base class

public:

void eat() {

std::cout << "Eating..." << std::endl; }

};

class Dog : public Animal { // Derived class

public:

void bark() {

std::cout << "Barking..." << std::endl }

};

37. Explain the different types of inheritance in C++.

Ans- **1. Single Inheritance**

One **derived class** inherits from **one base class**.

cpp

CopyEdit

class Animal {

public:

void eat() {

std::cout << "Eating..." << std::endl;

}

};

class Dog : public Animal {

public:

void bark() {

std::cout << "Barking..." << std::endl;

}

};

**Use when:** You have a simple "is-a" relationship.

**2. Multiple Inheritance**

One derived class inherits from **more than one base class**.

class A {

public:

void showA() { std::cout << "Class A" << std::endl; }

};

class B {

public:

void showB() { std::cout << "Class B" << std::endl; }

};

class C : public A, public B {

// Inherits from both A and B

};

**3. Multilevel Inheritance**

A class is derived from a class, which is itself derived from another class. (A → B → C)

cpp

class A {

public:

void showA() { std::cout << "Class A" << std::endl; }

};

class B : public A {

public:

void showB() { std::cout << "Class B" << std::endl; }

};

class C : public B {

public:

void showC() { std::cout << "Class C" << s

**4. Hierarchical Inheritance**

**One base class**, multiple derived classes.

cpp

CopyEdit

class Animal {

public:

void eat() {

std::cout << "Eating..." << std::endl;

}

};

class Dog : public Animal {

public:

void bark() { std::cout << "Bark!" << std::endl; }

};

class Cat : public Animal {

public:

void meow() { std::cout << "Meow!" << std::endl; }

};

**5. Hybrid Inheritance**

A **combination** of two or more types of inheritance (often includes multiple + multilevel).

cpp

class A {

public:

void showA() { std::cout << "A" << std::endl; }

};

class B : public A {};

class C : public A {};

class D : public B, public C {}; // Ambiguity from A

38. How do you implement single inheritance in C++?

Ans-What is Single Inheritance?

It’s when one class (derived) inherits from one base class.  
It helps in reusing code and extending functionality.

Step-by-Step Implementation**:**

#include <iostream>

using namespace std;

// Base class

class Animal {

public:

void eat() {

cout << "Animal is eating..." << endl;

}

};

// Derived class

class Dog : public Animal {

public:

void bark() {

cout << "Dog is barking..." << endl;

}

};

int main() {

Dog d;

d.eat(); // Inherited from Animal

d.bark(); // Defined in Dog

return 0;}

39. What is multiple inheritance and how does it differ from single inheritance?

Ans-

| **Feature** | **Single Inheritance** | **Multiple Inheritance** |
| --- | --- | --- |
| **Number of Base Classes** | Only one | Two or more |
| **Code Simplicity** | Easier to read and maintain | More complex and can lead to ambiguity |
| **Example** | class B : public A | class C : public A, public B |
| **Ambiguity** | No ambiguity | Can lead to diamond problem (if both base classes have same members) |
| **Use Case** | Simple hierarchies | When you need to combine features from multiple sources |

40. Describe hierarchical inheritance with an example.

Ans- In Hierarchical Inheritance, multiple derived classes inherit from a single base class.

Think of one common parent (base class) and many children (derived classes).

41. What is multilevel inheritance and how is it implemented in C++?

Ans- n multilevel inheritance, a class is derived from another derived class — forming a chain.

It looks like this:  
Class A → Class B → Class C

Each level inherits properties from the class above it.

#include <iostream>

using namespace std;

// Base class

class Animal {

public:

void eat() {

cout << "Animal is eating..." << endl;

}

};

// Derived class from Animal

class Dog : public Animal {

public:

void bark() {

cout << "Dog is barking..." << endl;

}

};

// Further derived class from Dog

class Puppy : public Dog {

public:

void weep() {

cout << "Puppy is weeping..." << endl;

}

};

int main() {

Puppy p;

p.eat(); // From Animal

p.bark(); // From Dog

p.weep(); // From Puppy

return 0;

}

42.Explain the concept of hybrid inheritance.

Ans- Hybrid Inheritance is a type of inheritance in object-oriented programming where more than one type of inheritance is combined in a single program. It typically involves a mix of:

Single Inheritance

Multiple Inheritance

Multilevel Inheritance

Hierarchical Inheritance

The main goal of hybrid inheritance is to take advantage of the features of multiple types of inheritance to design a more flexible and efficient class structure.

43. What are access modifiers in C++ and what are the different types?

Ans- Public

Members are accessible from anywhere in the program.

class MyClass {

public:

int x; // Public member

};

You can access x using an object: obj.x

2. Private

Members are accessible only within the same class.

Cannot be accessed directly outside the class.

class MyClass {

private:

int x; // Private member

};

To access private members, you need to use public member functions.

3. Protected

Members are accessible within the same class and derived (child) classes.

44. How do public, private, and protected access modifiers affect inheritance?

Ans- Effect of Access Modifiers on Inheritance

1. Public Inheritance (class Derived : public Base)

public members of base → remain public in derived.

protected members of base → remain protected in derived.

private members of base → not accessible in derived

2. Protected Inheritance (class Derived : protected Base)

public members of base → become protected in derived.

protected members of base → stay protected.

private members of base → still not accessible.

3. Private Inheritance (class Derived : private Base)

public and protected members of base → become private in derived.

private members of base → not accessible in derived.

45. Explain how access modifiers control member accessibility in derived classes.

Ans-

46. What is function overriding in the context of inheritance?

Ans- Function Overriding in C++ occurs when a derived class provides a new implementation of a member function that is already defined in its base class.

This is done to change or extend the behavior of that function for the derived class.

47. How do you override a base class function in a derived class?

Ans- To override a base class function in a derived class in C++, you need to follow a few simple rules. Here's how you can do it step by step:

Steps to Override a Base Class Function:

1. Declare the base class function as virtual

This tells the compiler to support runtime polymorphism.

2. Use the same function signature in the derived class

Same name, return , and parameters.

3. (Optional but recommended) Use the override keyword in the derived class

Helps catch errors if the function doesn’t correctly match the base class function.

48. Explain the use of the "virtual" keyword in function overriding.

Ans- The virtual keyword in C++ is used in function overriding to enable runtime polymorphism. It tells the compiler to use dynamic (late) binding instead of static (early) binding when calling a function through a base class pointer or reference.

49. What is the significance of the "override" specifier in C++11 and later?

Ans-

50. What is a virtual base class in C++ and why is it used?

Ans- A virtual base class in C++ is used in multiple inheritance to avoid the “diamond problem” — where a class inherits the same base class multiple times through different paths, causing duplication of members.

Why Use a Virtual Base Class?

To prevent multiple copies of the same base class.

To resolve ambiguity in diamond inheritance.

To ensure consistency and avoid unnecessary memory duplication.

51. How do you declare and implement a virtual base class?

Ans-

52. Explain the role of virtual base classes in resolving ambiguity in multiple inheritance.

Ans- Role of Virtual Base Classes in Resolving Ambiguity in Multiple Inheritance

When a class is derived from two or more classes that share a common base class, this forms a diamond-shaped inheritance. This can cause ambiguity because the derived class ends up with multiple copies of the base class.

53. Provide an example of using a virtual base class to avoid the diamond problem in inheritance.

Ans-

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