OBJECTIVE

- To comprehend inheritance and how it functions in object-oriented programming (OOP).
- To apply several inheritance types, including multilayer, multiple, and single inheritance.

BACKGROUND THEORY

One of the core ideas of object-oriented programming (OOP) is inheritance. It permits an existing class (referred to as the base class) to pass on its behaviors and attributes (data members and member functions) to a new class (referred to as the derived class). This encourages logical organization and code reuse in programming.

Purpose and Benefits:

- **Code Reusability**: Once a class is written, it can be reused by other classes through inheritance, avoiding redundant code.
- **Extensibility**: Existing code can be extended with new features without modifying the original class.
- **Maintainability**: Organized and hierarchical structure makes code easier to maintain.
- **Polymorphism Support**: Inheritance works hand in hand with polymorphism for dynamic behavior at runtime.

Types of Inheritance in C++:

1. **Single Inheritance**: A derived class inherits from one base class.

```
class A {
public:
   void display() { cout << "Base class A"; }
};
class B : public A {
};
```

2. **Multilevel Inheritance**: A class is derived from a derived class.

```
class A { };
class B : public A { };
class C : public B { };
```

3. **Multiple Inheritance**: A class inherits from more than one base class.

```
class A { };

class B { };

class C : public A, public B { };
```

4. **Hierarchical Inheritance**: Multiple derived classes inherit from a single base class.

5. **Hybrid Inheritance**: A combination of two or more types of inheritance.

Access Specifiers in Inheritance:

the derived The type of inheritance (public, protected, or private) affects the accessibility of base class members in the derived class:

- **Public inheritance**: Public and protected members of the base class remain public and protected in the derived class.
- **Protected inheritance**: Public and protected members become protected in the derived class.
- **Private inheritance**: All inherited members become private in class.

Example:

```
class Animal {
public:
   void eat() {
      cout << "Eating..." << endl;
   }
};

class Dog : public Animal {
public:
   void bark() {
      cout << "Barking..." << endl;
   }
};
```

Here, the class Dog inherits the eat() function from the base class Animal and also defines its own function bark().

Virtual Base Class (in Multiple Inheritance):

When multiple paths to a base class exist, ambiguity may arise. This is resolved using the virtual keyword.

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class A { };

class B : virtual public A { };

class C : virtual public A { };

class D : public B, public C { };

Operator Overloading is one of the most important features of Object-Oriented Programming in C++ that allows us to redefine the way operators work for user-defined data types (like classes and structures). By overloading operators, we can perform operations such as addition, subtraction, comparison, etc., on objects as if they were built-in data types.

1. **Create a base class Shape** with a method display(), create a derived class Circle that inherits from Shape and has an additional method draw() and implement a main() function to demonstrate the usage of these classes.

#include <iostream>

using namespace std;

class Shape {

public:

void display() {

cout << "This is a shape." << endl;

}

};

class Circle : public Shape {

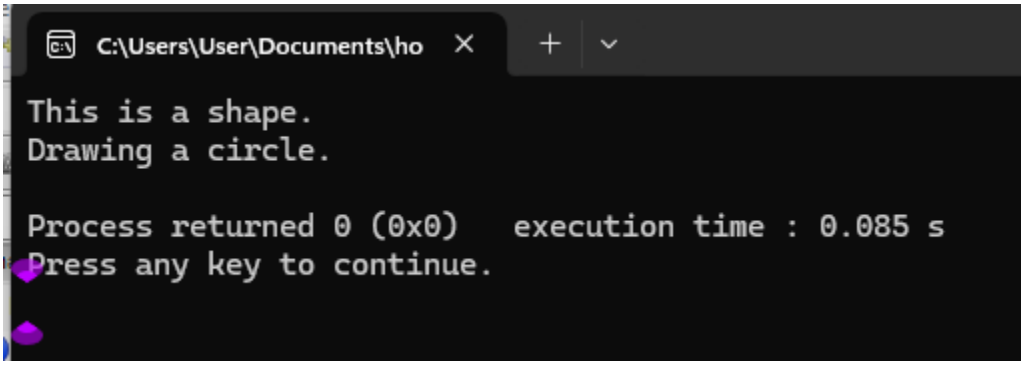
public:

void draw() {

cout << "Drawing a circle." << endl;

```
}
};
int main() {
Circle c;
c.display(); // Inherited from Shape
c.draw(); // Defined in Circle
return 0;
}
```

Output:



2. Create two base classes Person and Employee with appropriate methods, create a derived class Manager that inherits from both Person and Employee and implement a main() function to demonstrate the usage of these classes.

```
#include <iostream>
using namespace std;
class Person {
public:
void name() {
```

```
cout << "Name: Aastha Gaire " << endl;
}
};
class Employee {
public:
void role() {
cout << "Role: Manager" << endl;
}
};
class Manager : public Person, public Employee {
public:
void details() {
cout << "Manager Details:" << endl;
name();
role();
} };
int main() {
Manager m;
m.details();
return 0;
}
```

```
Manager Details:
Name: Aastha Gaire
Role: Manager

Process returned 0 (0x0)   execution time : 0.187 s
Press any key to continue.
```

Discussion

A key idea in object-oriented programming that encourages code reuse and hierarchical relationships between classes, inheritance was examined in this lab in C++. We gained an understanding of how members and methods may be shared and extended by developing base and derived classes**.**

Conclusion

We gained a better understanding of how to use class hierarchies to create structured and scalable applications thanks to the inheritance lab. In addition to reducing code redundancy, inheritance makes designs more adaptable and manageable. We learned how to model real-world relationships in object-oriented programming by learning inheritance through hands-on coding.