2/04/2023

4 pillars of OOPs

We can say everything is abstraction. 4 pillars of OOPs are :-

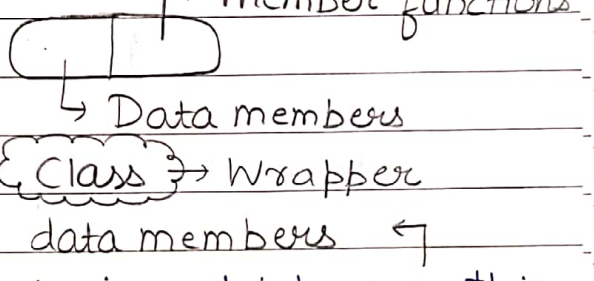
1) Encapsulation
2) Inheritance
3) Polymorphism
4) Abstraction → Implementation hiding

Encapsulation

Wrapping of data members & member functions in the capsule (class) is known as encapsulation. By this we are trying to achieve data hiding.

↱ capsule

```
class {
    // Data members
    // Member functions
};
```



Perfect encapsulation is that in which everything is set as private. We can access these private elements via setter & getter.

By this we are increasing the security, like what type of data to show & what type of data not to show.

Note → Abstract ⇒ not going into much details

Ex →

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

Inheritance

There will be a super / parent / base class and there will be subclass / child / derived class. Derived class will inherit the properties of base class. There can be multiple derived classes as well.

Syntax

```
class child : mode parent
              ↳ public, private, protected
```

Ex→

```
class Animal {
    public :
        int age ;
        void eat() {
            cout << "Eating" ;
        }
};
class Dog : public Animal {

};
main() {
    Dog d1;
    d1.eat();
}
```

O/p → Eating

The above code did not give an error as the data members & member functions gets inherited to the Dog class i.e. child or derived class.

Chart of inheritance

Base class access modifier	Type of inheritance		
	Public	Protected	Private
Public	Public	Protected	Private
Protected	Protected	Protected	Private
Private	NA	NA	NA

NA → Not accessible

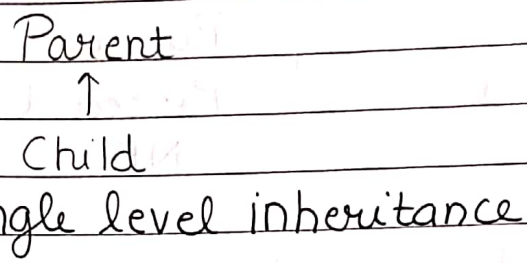
Ex→
```
class Animal {
    public :  → Base class access modifier
        int age ;
        void eat () { -- }
};
class Dog : public Animal {   ↑ Type of inheritance

        int age ;  → public
        void eat () { -- } → public
};
```
} Inherited from base class

when
Hence we were doing D1.eat(), we were not getting an error as eat function was in public mode.

Protected mode (access modifier)
Accessible in derived class. This is combination of private + (only accessible in the derived class).
Private → not inherited
Protected → inherited

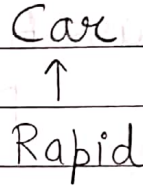
Types of inheritance

1) Single Level inheritance → There is one base class and only one child class.



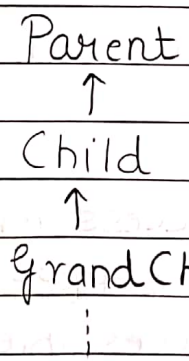
Single level inheritance

Ex→
```
class car {
    ----
};
class rapid : public car {
    ---
};
```



Note → Inheritance is basically is-a relation. We can say rapid is a car.
↳ derived class ↳ base class

2) Multilevel inheritance

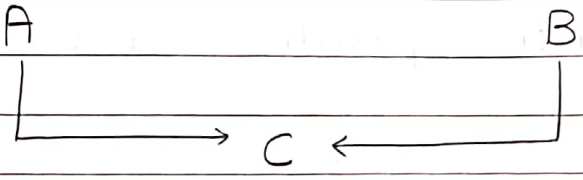


There can be many levels.
Here also is-a relationship will be followed.

Ex→
```
class Fruit { ... };
class mango : public Fruit { ... };
class alphanso : public mango { ... };
```

Note→ Hence we can say alphanso is a mango & mango is a fruit.

3) Multiple inheritance

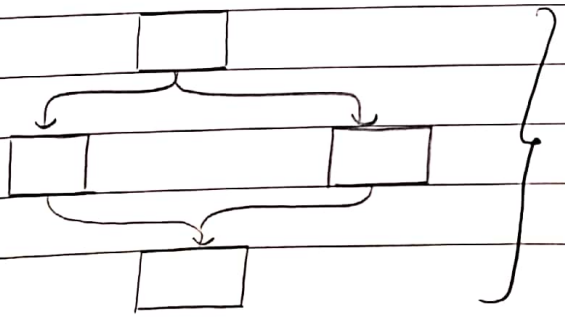


There are two base classes and single child or derived class.

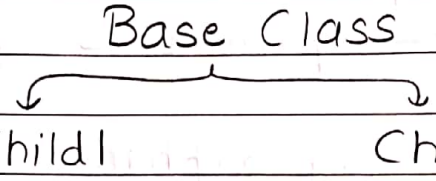
Ex→
```
class A { ... };
class B { ... };
class C : public A, public B { ... };
```

There is a problem in the above inheritance, that what if there are same items in A & B class & hence compiler can get confused here. This is known as diamond problem & we can solve it by scope resolution operator.

```
C obj;
cout << obj.B :: var_name;
```
→ using var_name of class B

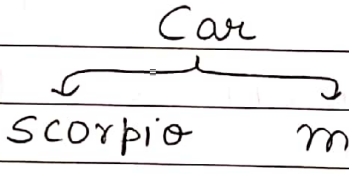


4) Hierarchical Inheritance



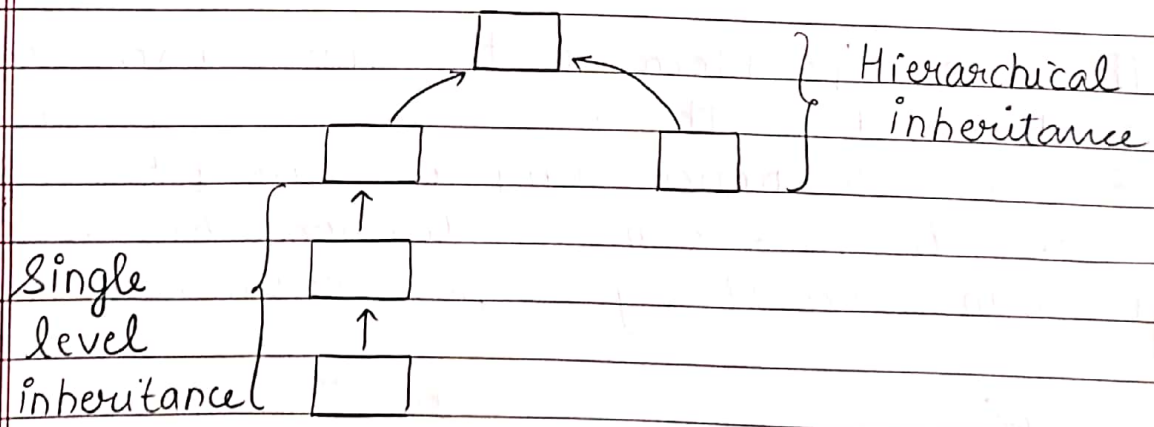
Single base class, multiple derived classes.

Ex→
```
class car { --- };
class scorpio : public car { -- };
class maruti : public car { -- };
```



Scorpio is a car and maruti is a car.

5) Hybrid inheritance → It is the mixture of above studied inheritances.



Polymorphism → Important for interviews
Poly → many
morph → forms
This means existing in many forms.

There are 2 types of polymorphism namely compile time & run time polymorphism.

1) Compile time polymorphism
It is based on operator overloading & function overloading.

* Function overloading

```
class Maths {
    public :
        int sum (int a, int b) {
            return a+b;
        }
        int sum (int a, int b, int c) {
            return a+b+c;
        }
        int sum (int a, float b) {
            return a+b;
        }
};
main() {
    Maths obj;
    cout << obj.sum (2,3);      // 1st func
    cout << obj.sum (2,3,5);    // 2nd func
    cout << obj.sum (2,5.6f);   // 3rd func
}
```

In function overloading, return type of function should be same.

* Operator overloading
For example using + operator, we can print the difference also & this can be done via

operator overloading.

Syntax

return_type operator + ( ) {

}

+ → operator symbol

a + b → a → current obj, b → input parameter, + → member function

Ex →

```
class Param {
    public :
        int val;
        void operator + (Param & obj2) {
            int value1 = this → val;
            int value2 = Obj2 . val;
            cout << (value1 - value2);
        }
};
main () {
    Param obj1 , obj2;
    obj1.val = 7;
    obj2. val = 2;

    obj1 + obj2 ; → 5
}
```

Note → obj1 ⇒ current object
+ ⇒ member function
obj2 ⇒ input parameter

This is basically operator overloading as + operator is existing in many forms such as addition of numbers, objects, concatenation etc.