



Object Oriented Programming

.NET

Object-Oriented Programming (OOP) is a programming paradigm based on the concept of "objects", which can contain data in the form of fields (attributes/properties), and code in the form of procedures (methods).

A feature of objects is an object's methods. They can access and modify the data fields of their object. In **OOP**, computer programs are designed by making them out of objects (classes) that interact with one another.

[HTTPS://EN.WIKIPEDIA.ORG/WIKI/OBJECT-ORIENTED_PROGRAMMING](https://en.wikipedia.org/wiki/Object-oriented_programming)

Object-Oriented Programming – Four Pillars

<https://www.linkedin.com/pulse/4-pillars-object-oriented-programming-pushkar-kumar#:~:text=>

The four pillars of OOP

- Abstraction : The process of showing only essential/necessary features of an entity/object to the outside world and hide the other irrelevant information.
- Encapsulation : Wrapping data and member functions (Methods) together into a single unit (class). Encapsulation automatically achieves the concept of data hiding. This provides security to data by making variables private and allowing public methods access to the private variables.
- Inheritance : Creating a new class from an existing class template. A class (subclass) acquires the properties and behavior of a 'base' ('super') class.
- Polymorphism: "many forms". A subclass can inherit functionalities or behavior of its parent/base class and define its own unique behavior.

Abstraction

<https://stackify.com/oop-concepts-c-sharp/#:~:text=>

Abstraction is the process by which a developer separates the relevant data from the irrelevant details in order to simplify use.

Abstraction in daily life

- Apartment Building. We determine what the building is for by its exterior or sign but don't know the specifics as to how the people live.
- Factory.
- Snail Mail.



Encapsulation

[https://en.wikipedia.org/wiki/Encapsulation_\(computer_programming\)](https://en.wikipedia.org/wiki/Encapsulation_(computer_programming))

Encapsulation the restricting of direct access to abstracted data.

Encapsulation prevents unauthorized parties' direct access to the members of a class. Publicly accessible methods are generally provided in the class (so-called "getters" and "setters") to access the values.



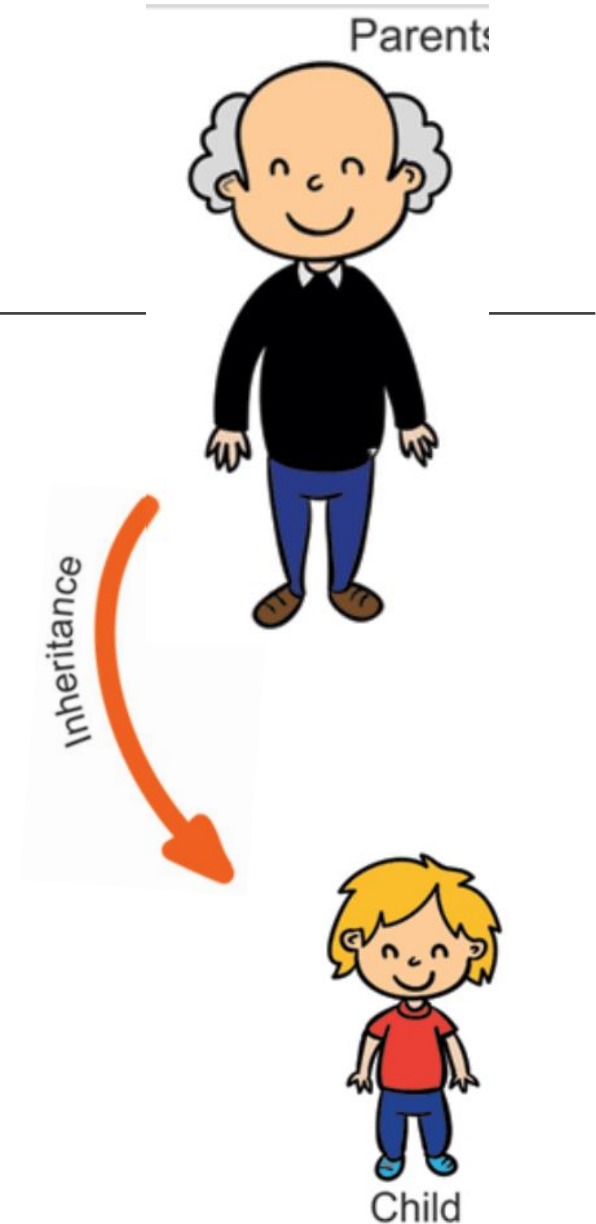
Inheritance

<https://docs.microsoft.com/en-us/dotnet/csharp/tutorials/inheritance#:~:text=>

Inheritance allows you to define a child class that reuses (inherits) the characteristics of a parent class.

The class that Inherits the members of the '**base**' class is called the '**derived**' class.

- structs, delegates, and enums do not support inheritance.

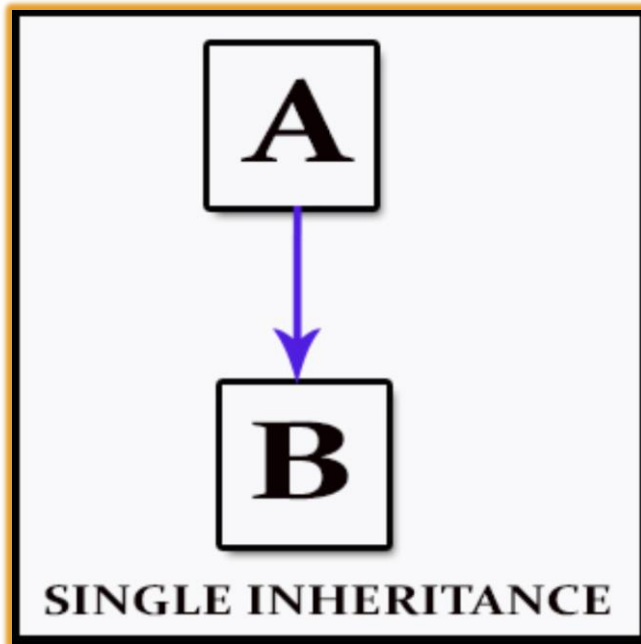


Inheritance - Types

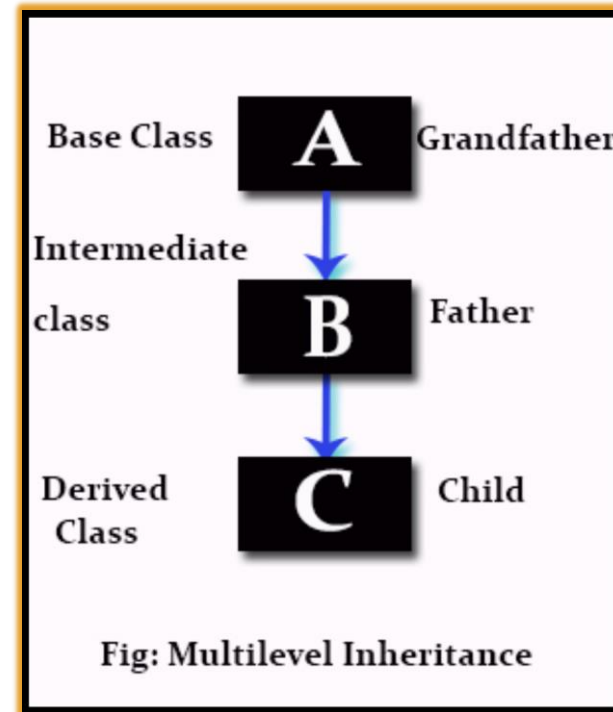
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[https://en.wikipedia.org/wiki/Inheritance_\(object-oriented_programming\)](https://en.wikipedia.org/wiki/Inheritance_(object-oriented_programming))

Single inheritance(C#) - where subclasses inherit the features of one superclass. A class acquires the properties of another class.



Multilevel inheritance(C#) - where a subclass is inherited from another subclass.



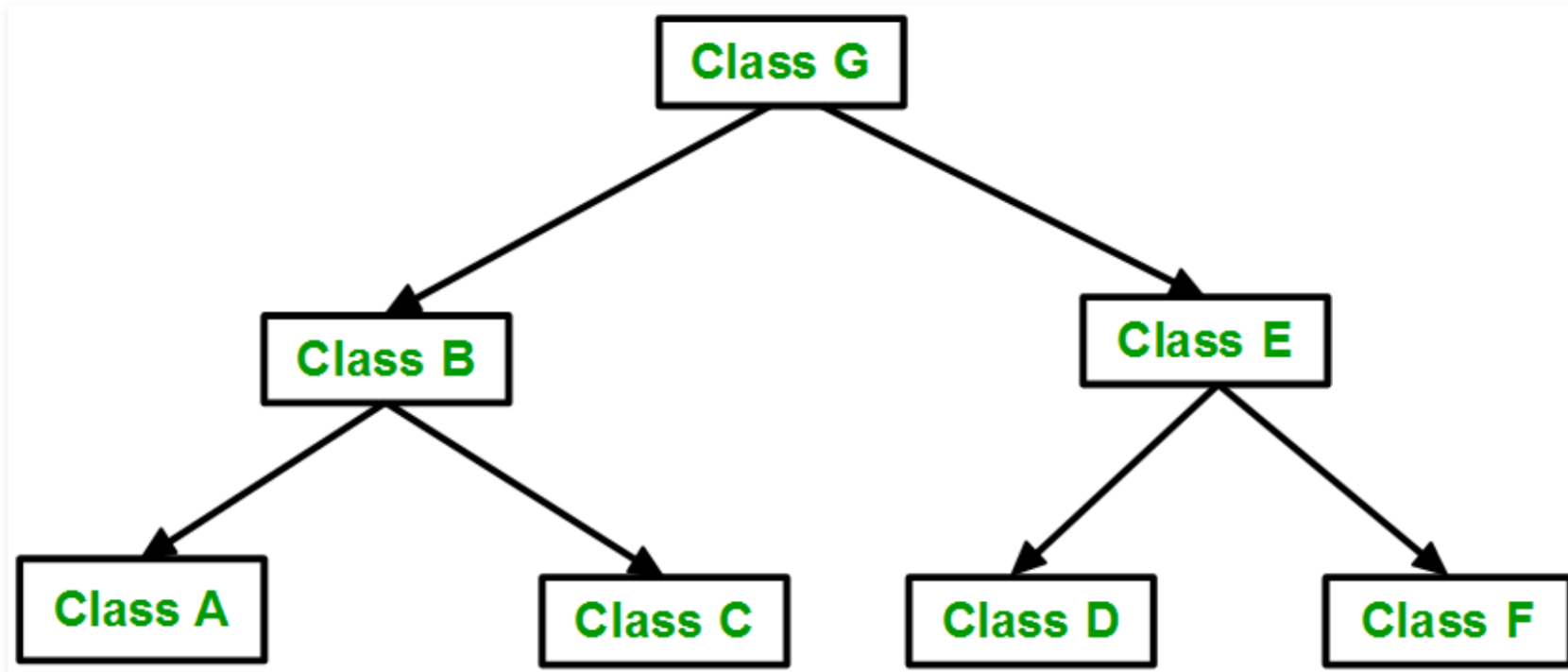
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[https://en.wikipedia.org/wiki/Inheritance_\(object-oriented_programming\)](https://en.wikipedia.org/wiki/Inheritance_(object-oriented_programming))

<https://www.geeksforgeeks.org/inheritance-in-c/>

Hierarchical inheritance(C#) - where one class serves as a superclass (base class) for more than one sub class.



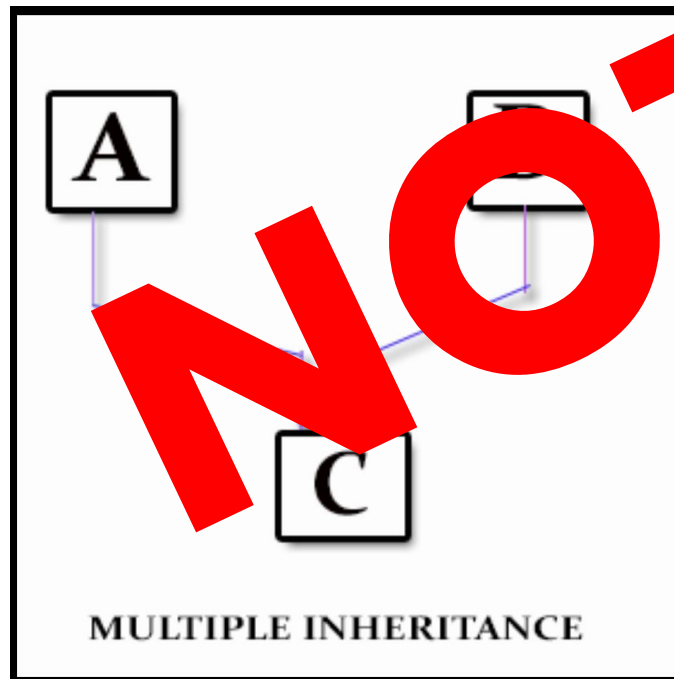
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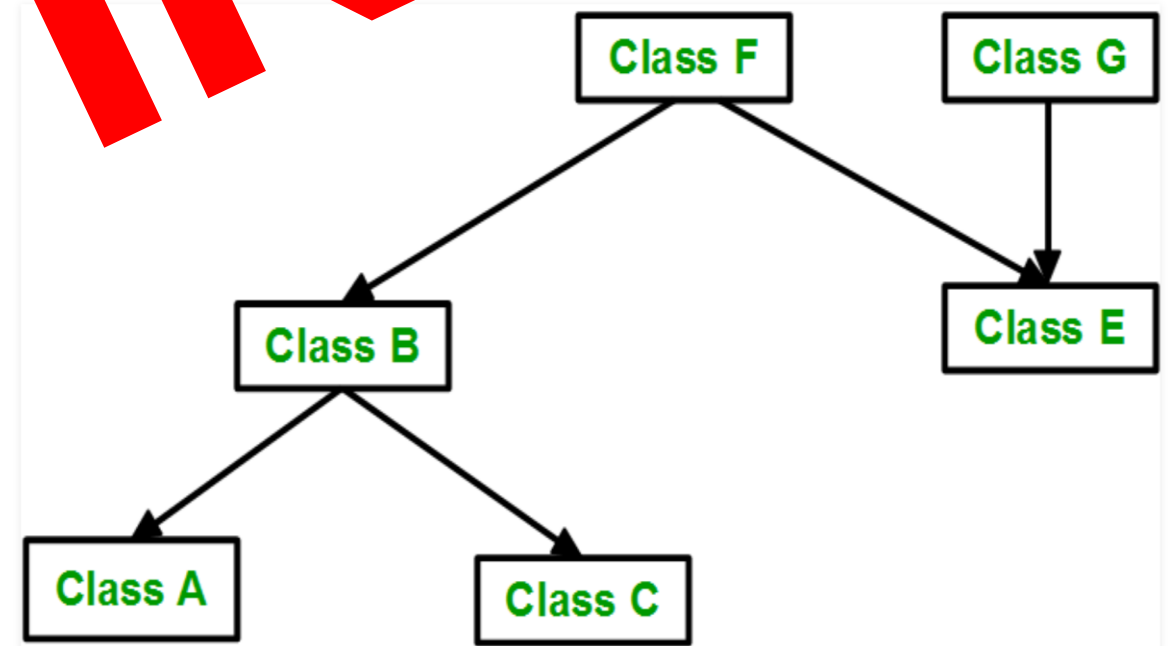
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Multiple inheritance(~~NOT IN C#~~) - one class can have more than one superclass and inherit features from all parent classes



Hybrid inheritance(~~NOT IN C#~~) - a mix of two or more types of inheritance.



Inheritance and Access Modifiers

<https://docs.microsoft.com/en-us/dotnet/csharp/tutorials/inheritance#:~:text=>

Access Modifiers affect inheritance

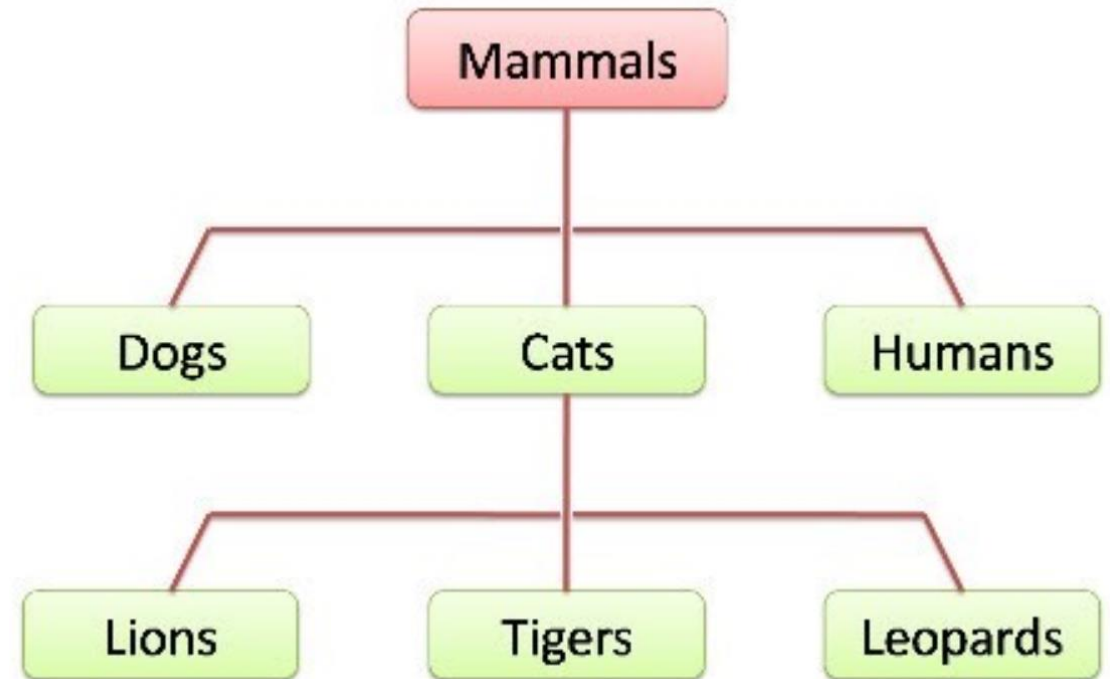
- [Protected](#) - visible only in *derived* classes.
- [Internal](#) - visible only in the same assembly as the *base* class.
- [Public](#) - visible in *derived* classes and are part of the *derived* class' public interface.
- Members of a *base* class that are NOT inherited by *derived* classes.
 - Static constructors – Which initialize the static data of a class.
 - Instance constructors – Each class must define its own constructors.

Inheritance – an ‘is a’ relationship

<https://docs.microsoft.com/en-us/dotnet/csharp/tutorials/inheritance#:~:text=>

Inheritance is used to express an "is a" relationship between a **base** class and one or more **derived** classes, where the **derived** class ‘is a’ specialized version of the **base** class.

An ‘is-a’ relationship based on inheritance is best applied to add additional members to the **base** class or that require additional functionality not present in the **base** class.



Polymorphism

<https://docs.microsoft.com/en-us/dotnet/csharp/tutorials/inheritance#designing-the-base-class-and-derived-classes>

Polymorphism is when each *derived class* implements the same methods but in different ways.

If a *base class* member is marked *abstract*, it must be defined in the *derived class*.

Only *virtual base class* members may be *overridden*.

Only *derived* class members using the *override* keyword may implement an alternative definition of the *virtual base class* member.

```
using System;

public abstract class Shape
{
    public abstract double Area { get; }

    public abstract double Perimeter { get; }

    public override string ToString() => GetType().Name;

    public static double GetArea(Shape shape) => shape.Area;

    public static double GetPerimeter(Shape shape) => shape.Perimeter;
}

public class Square : Shape
{
    public Square(double length)
    {
        Side = length;
    }

    public double Side { get; }

    public override double Area => Math.Pow(Side, 2);

    public override double Perimeter => Side * 4;

    public double Diagonal => Math.Round(Math.Sqrt(2) * Side, 2);
}
```


Activity

Complete the implementation of the [Publication => Book](#) program.