SPRING 2021

Object Oriented Programming

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Object Oriented Programming (OOP)

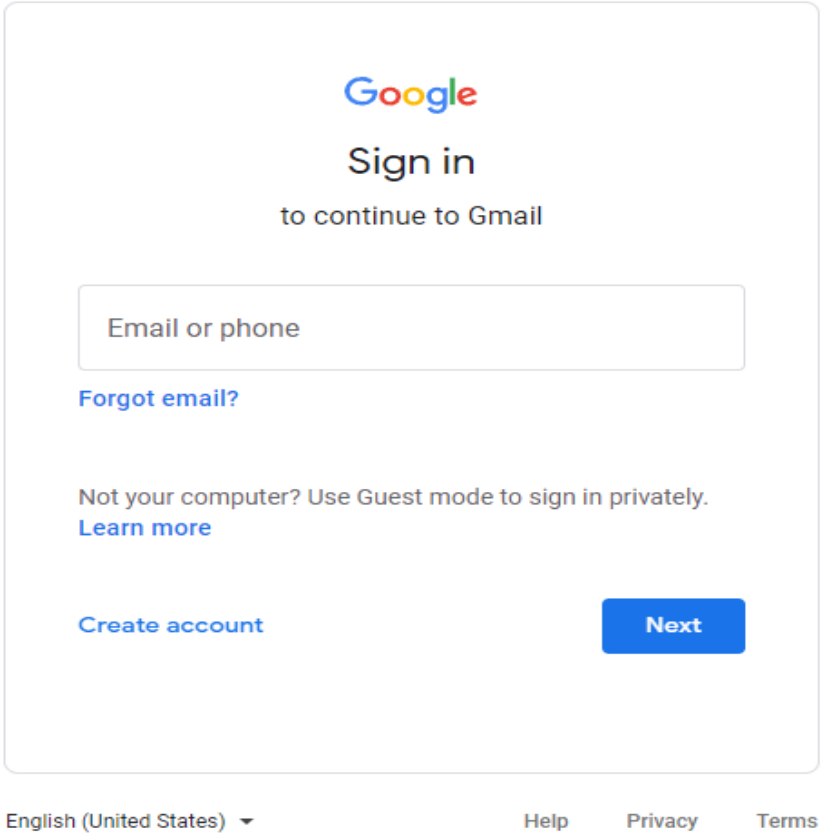
Software Development

Collection of Programs

A Program is set of Instructions

An Instruction is a combination of data items

A data item is an object



A Real-world entity the impact of existence of the thing shows in the real-world

Syllabus

1. Introduction to OOP: Object-oriented thinking: Agents and Communities, messages and methods, Responsibilities, Classes and Instances, Class Hierarchies- Inheritance, Method binding, Overriding and Exceptions, Summary of Object-Oriented concepts. Understanding the Object Oriented Development: Responsibility, Agents, Building blocks of OOP

2. Java Programming Fundamentals: Java Buzzwords, Data Types, Variables, Arrays, Operators, Expressions, Control Statements, Type conversion and type casting, Simple Java Programming, Concepts of classes, Objects, Constructors, Methods, Access Control, “this” keyword, Garbage Collection.

3. Overloading methods and constructors, Parameter passing, Recursion, Nested Inner classes, Exploring string class.

4. Inheritance– Inheritance concept, Inheritance basics, Member access, Constructors, Creating Multilevel hierarchy, super uses, using final with inheritance, abstract classes, Object class, forms of inheritance- specialization, specification, construction, extension, limitation, combination, benefits of inheritance, costs of inheritance.

5. Defining, applying and implementing interfaces; method overriding, super and final keywords, polymorphism, generics, defining, finding and importing packages, exceptions handling with try, catch, throw, throws and finally keywords.

6. Interfaces: Introduction, Interface Vs Abstract class, Implementing interface, Extending Interface. Examples problems.

Text Book

- 1. Herbert Schildt, Java A Beginner’s Guide, Seventh Edition, 2017. 14

Reference Book

- 2. Deitel H. and Deitel P., JAVA - How to Program, Pearson Education (2003).

Evaluation Plan

- **Continuous Assessment: 25 M**
- **Midterm Examination: 25 M**
- **End-term Examination: 50 M**

Submissions

- Google Classroom

What is object-oriented programming (OOP)?

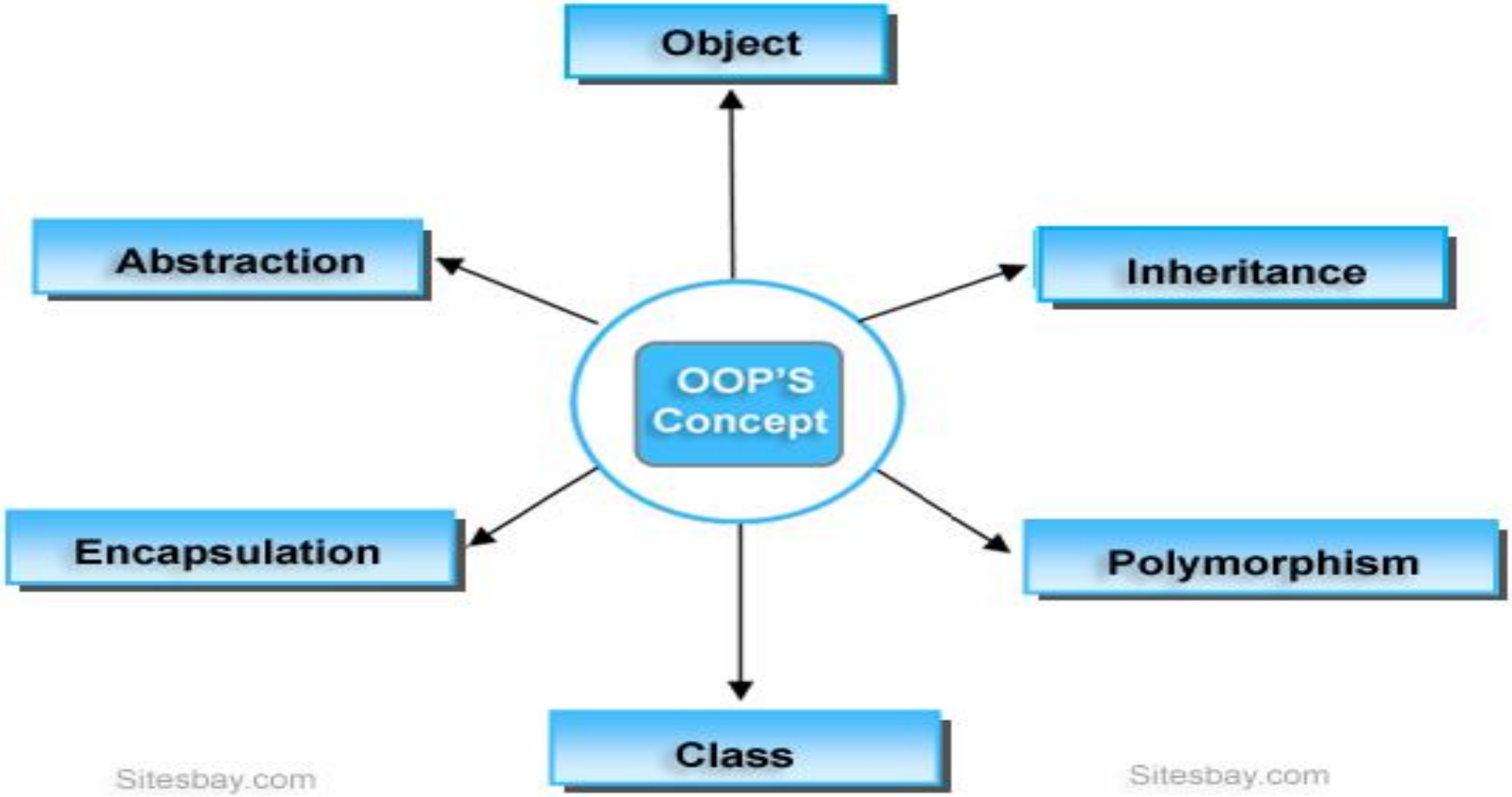
- OOP is a computer programming model that organizes **software design** around **data**, or **objects**, **rather than functions and logic.**
- An object can be defined as a data field that has **Identity, State**, **unique attributes** and **behavior**.
- OOP focuses on the objects that developers want to manipulate rather than the logic required to manipulate them.
- **This approach to programming is well-suited for programs that are large, complex and actively updated or maintained.**
- This includes programs for manufacturing and design, as well as mobile applications;
- Benefits of OOP include code **reusability, scalability and efficiency**.
- The first step in OOP is to collect all of the objects a programmer wants to manipulate and identify how they relate to each other is known as **data modeling.**
- Examples of an object can range from physical entities, such as a human being who is described by properties like name and address, to small computer programs, such as **widgets.**
- Once an object is known, it is labeled with a **class** of objects that defines the kind of data it contains and any logic sequences that can manipulate it.
- **Each distinct logic sequence is known as a method.**
- Objects can communicate with well-defined interfaces called messages.

What is the structure of object-oriented programming?

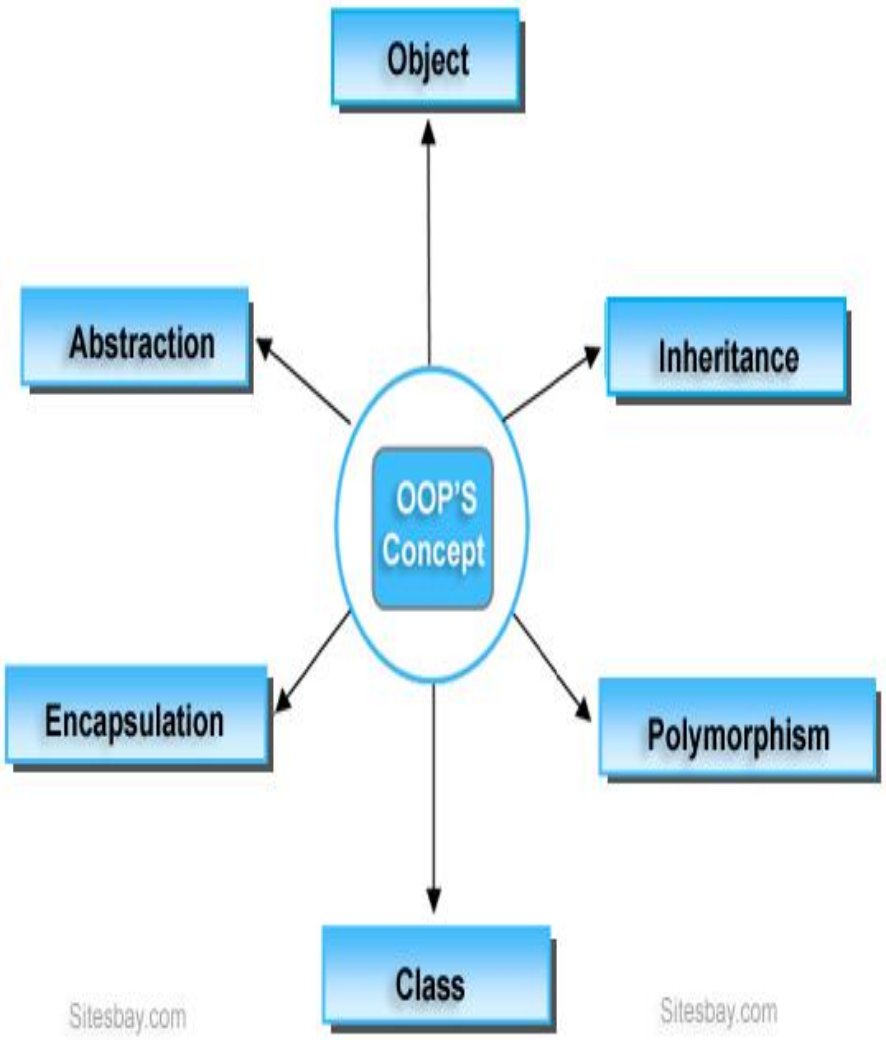
The structure, or building blocks, of object-oriented programming include the following:

- **Classes** are user-defined data types that act as the blueprint for individual objects, attributes and methods.
- **Objects** are instances of a class created with specifically defined data.
  - Objects can correspond to real-world objects or an abstract entity.
  - When class is defined initially, the description is the only object that is defined.
- **Methods** are functions that are defined inside a class that describe the behaviors of an object.
  - Each method contained in class definitions starts with a reference to an instance object.
  - Additionally, the subroutines contained in an object are called instance methods.
  - Programmers use methods for reusability or keeping functionality encapsulated inside one object at a time.
- **Attributes** are defined in the class template and represent the state of an object.
  - Objects will have data stored in the attributes field.
  - Class attributes belong to the class itself.

Object Oriented Methodologies



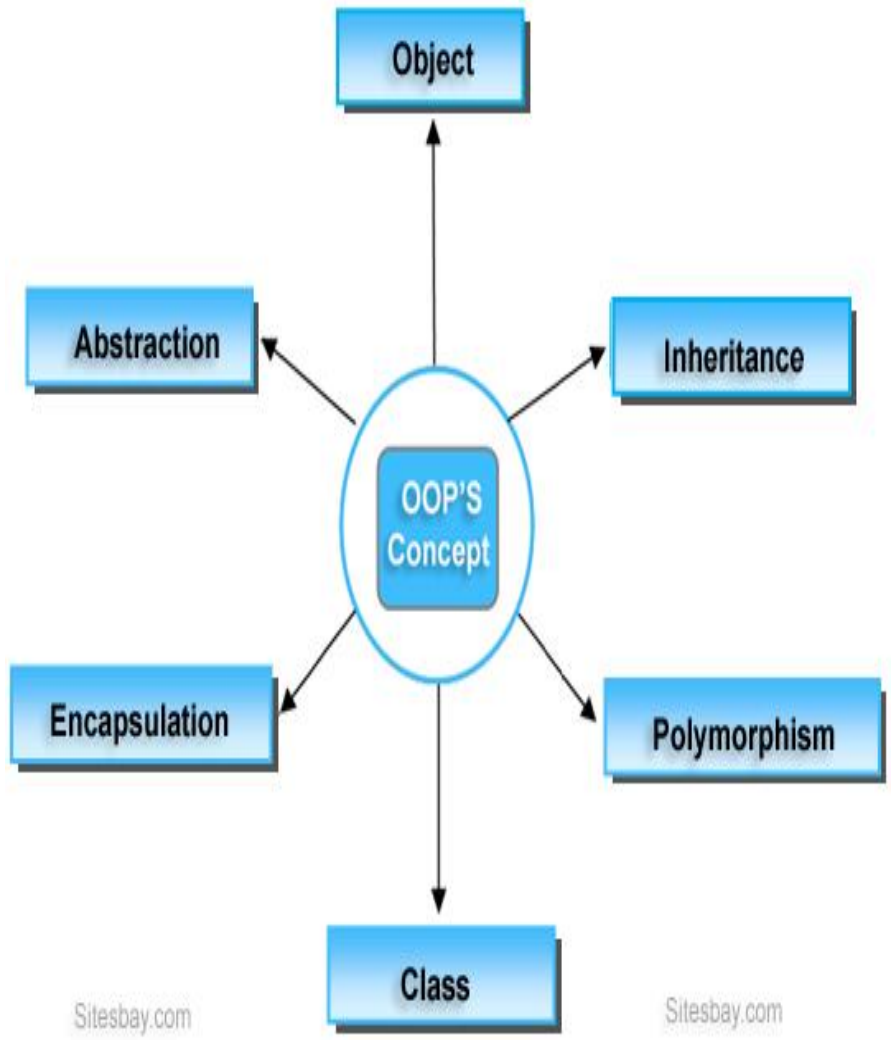
Object Oriented Methodologies : Abstraction



Abstraction:

- Objects only reveal **internal mechanisms** that are relevant for the use of other objects.
- **Hiding** any unnecessary implementation code.
- The derived class can have its functionality extended.
- This concept can help developers more easily make additional changes or additions over time.

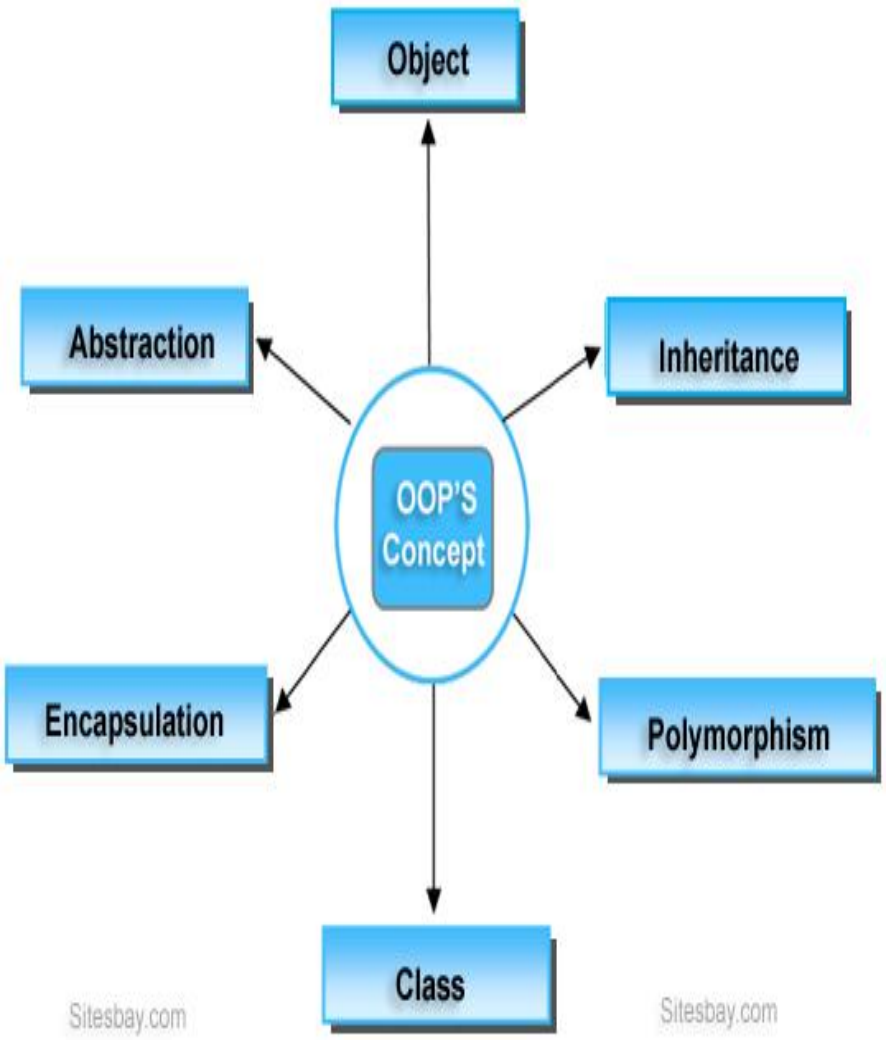
Object Oriented Methodologies: Encapsulation



Encapsulation: This principle states that all important information is contained inside an object and only select information is exposed.

- The implementation and state of each object are privately held inside a defined class.
- Other objects do not have access to this class or the authority to make changes.
- They are only able to call a list of public functions or methods.
- This characteristic of data hiding provides greater program security and avoids unintended data corruption.

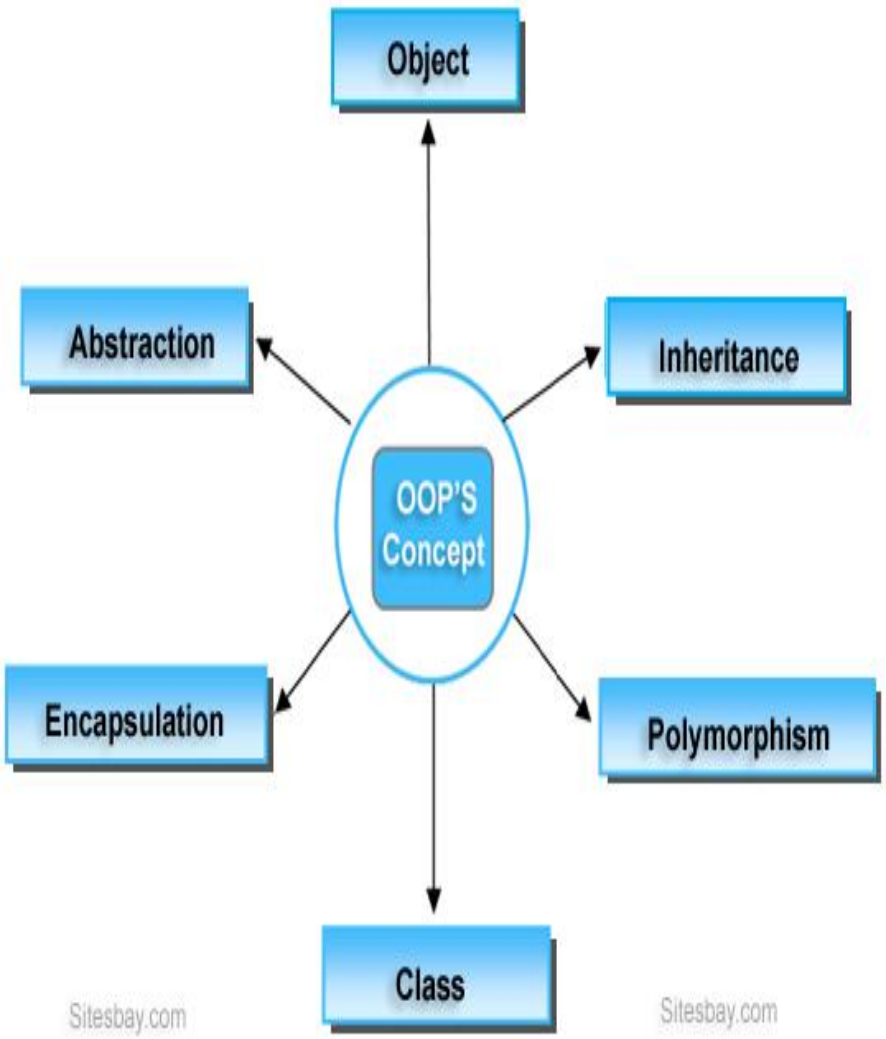
Object Oriented Methodologies: Inheritance



Inheritance: Classes can **reuse** code from other classes.

- Relationships and subclasses between objects can be assigned, enabling developers to reuse common logic while still maintaining a unique hierarchy.
- This property of OOP forces a more thorough data analysis, reduces development time and ensures a higher level of accuracy.

Object Oriented Methodologies: Polymorphism



Polymorphism: Objects are designed to share behaviors and they can take on **more than one form.**

- The program will determine which meaning or usage is necessary for each execution of that object from a parent class, reducing the need to duplicate code.
- A child class is then created, which extends the functionality of the parent class.
- Polymorphism allows different types of objects to pass through the same interface.

What are the benefits of OOP?

- **Modularity:** Encapsulation enables objects to be self-contained, making troubleshooting and collaborative development easier.
- **Reusability:** Code can be reused through inheritance, meaning a team does not have to write the same code multiple times.
- **Productivity:** Programmers can construct new programs quicker through the use of multiple libraries and reusable code.
- **Easily upgradable and scalable:** Programmers can implement system functionalities independently.
- **Interface descriptions:** Descriptions of external systems are simple, due to message passing techniques that are used for objects communication.
- **Security:** Using encapsulation and abstraction, complex code is hidden, software maintenance is easier and internet protocols are protected.
- **Flexibility:** Polymorphism enables a single function to adapt to the class it is placed in. Different objects can also pass through the same interface.