# Object-Oriented Programming

## Advanced Programming

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# Outline



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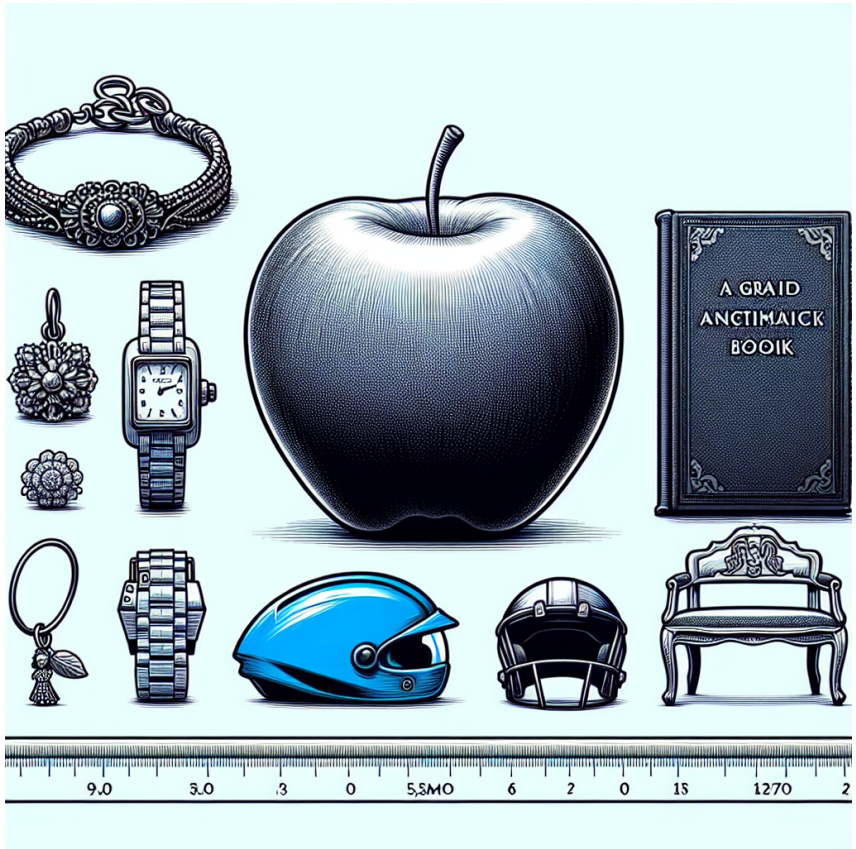
# Basics of Object-Oriented Design I

- **Object-oriented** has become one of the most traditional and popular **paradigms** in software development.
- It is based on the concept of **objects**, which can contain data, in the form of **fields** (often known as attributes or properties), and code, in the form of **procedures** (often known as methods).

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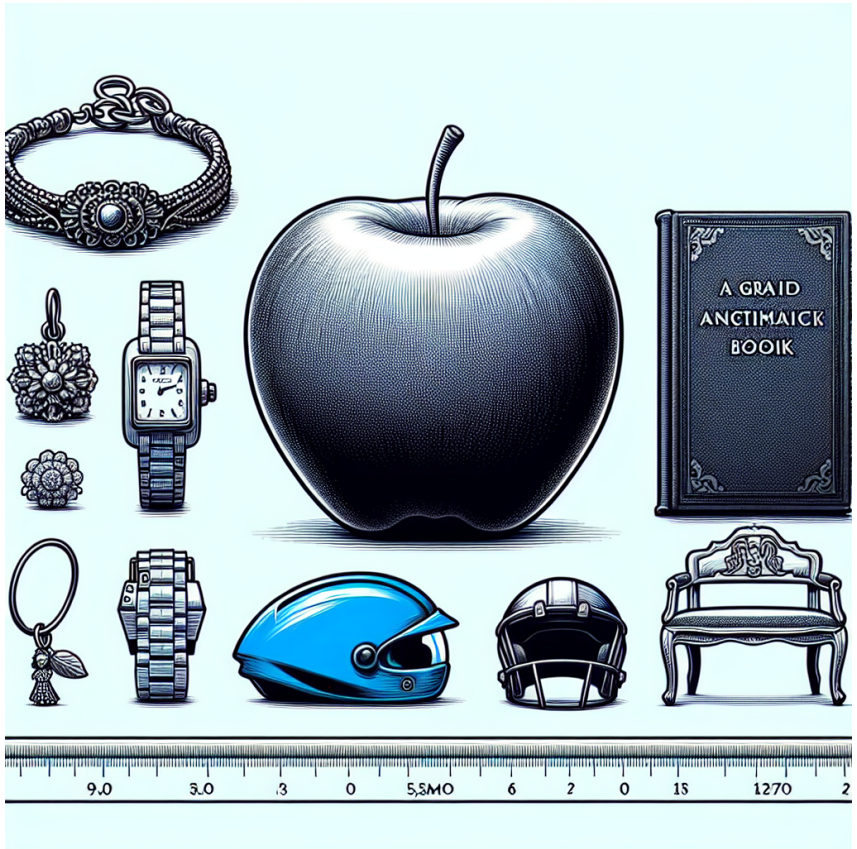


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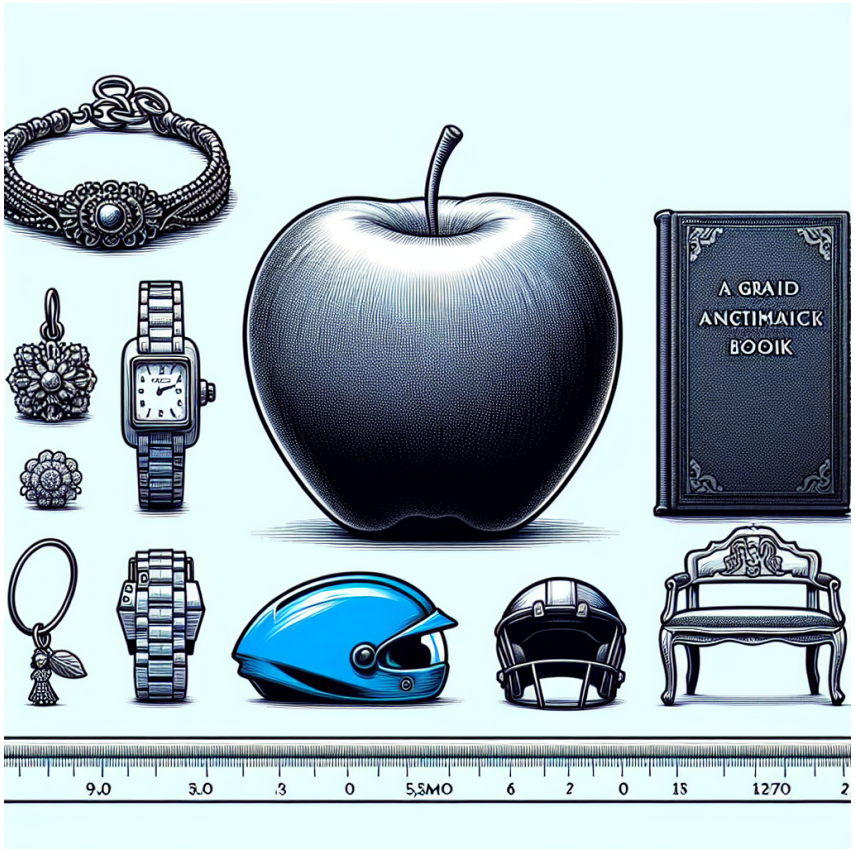


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- The idea is to design a **system modularly**, and to make it easier to maintain, and to understand. Also the idea is emphasize the reuse of code.
- The main principles of OOD are:
  - Abstraction
  - Encapsulation
  - Inheritance
  - Polymorphism

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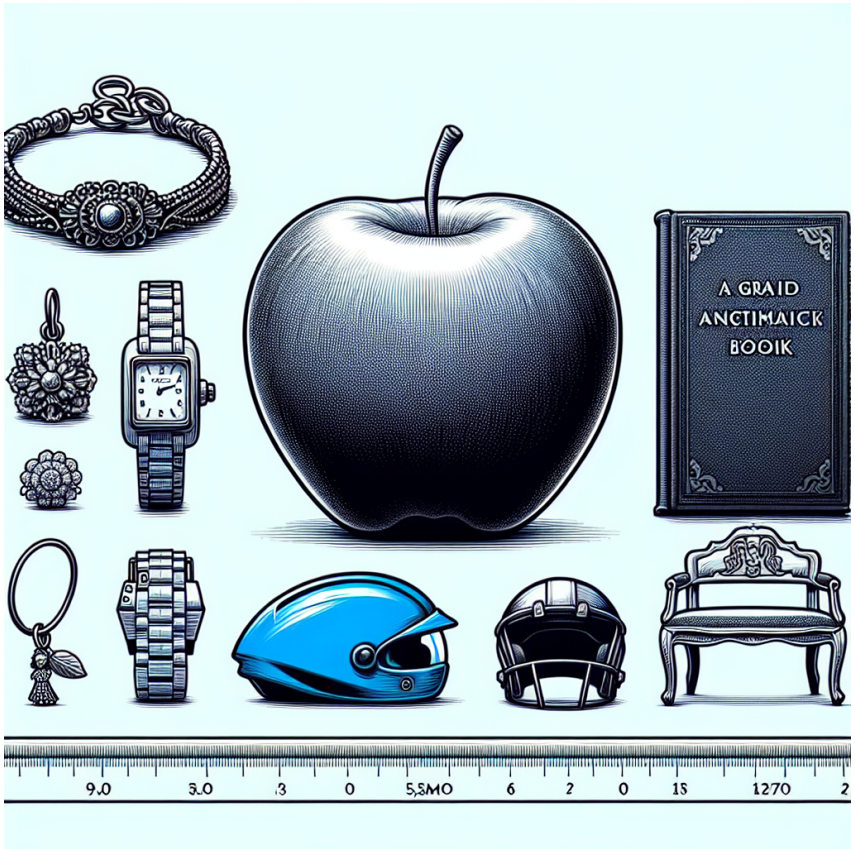


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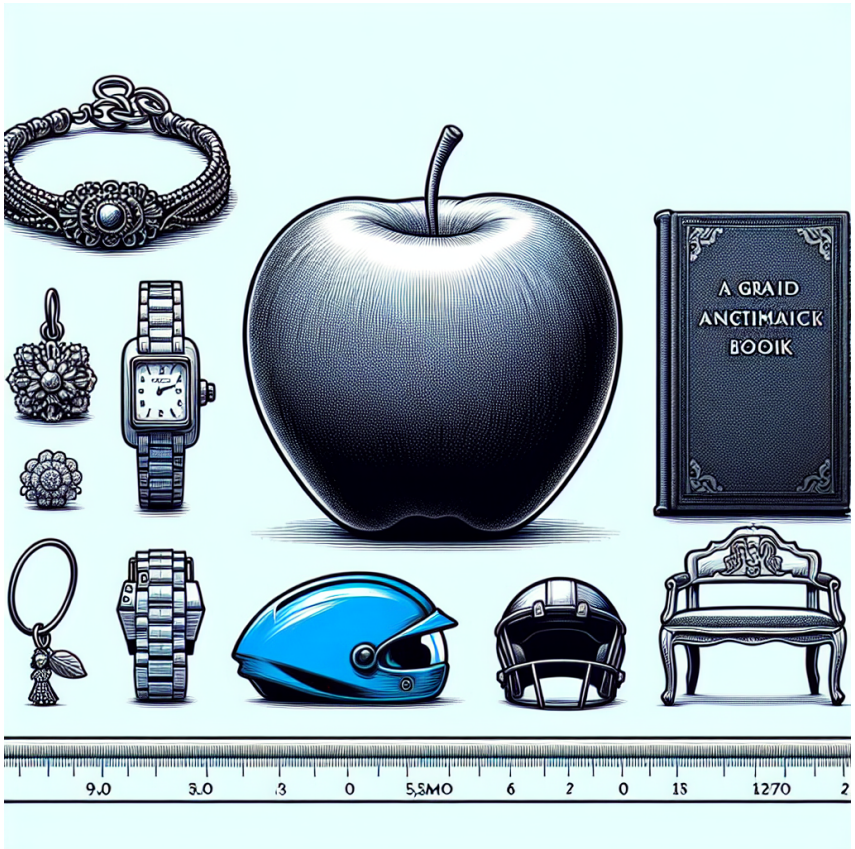


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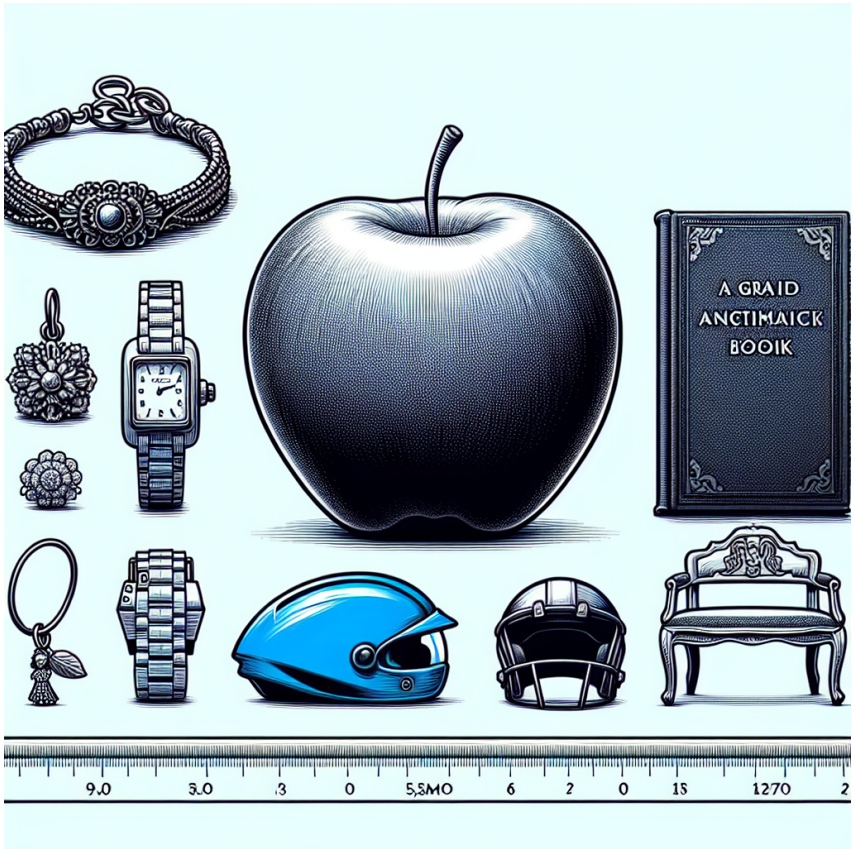


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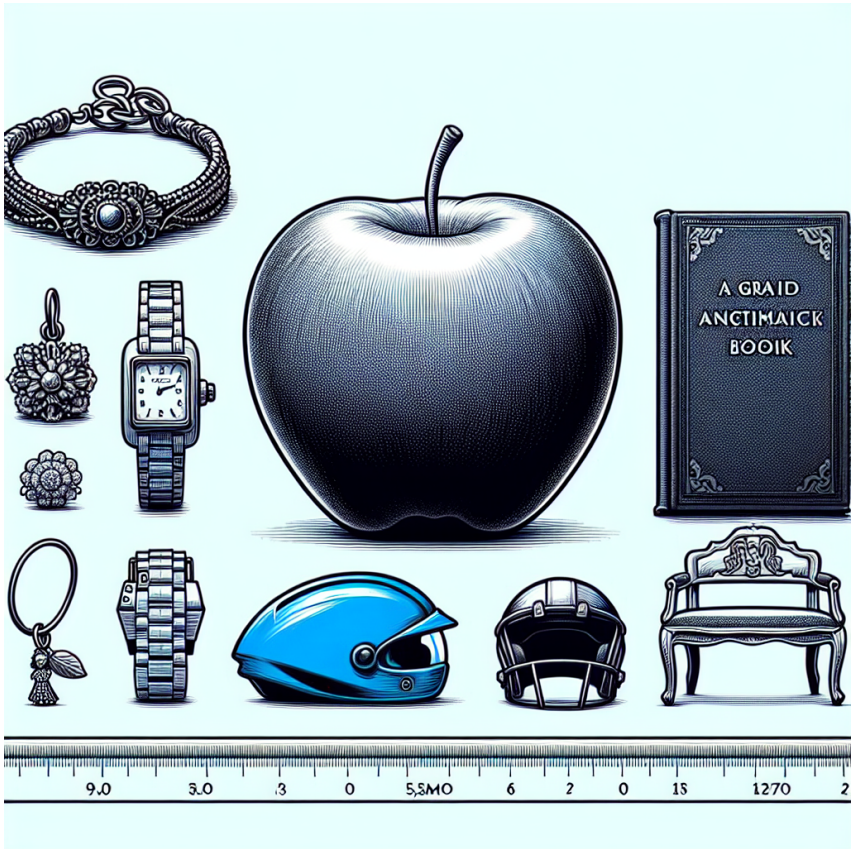


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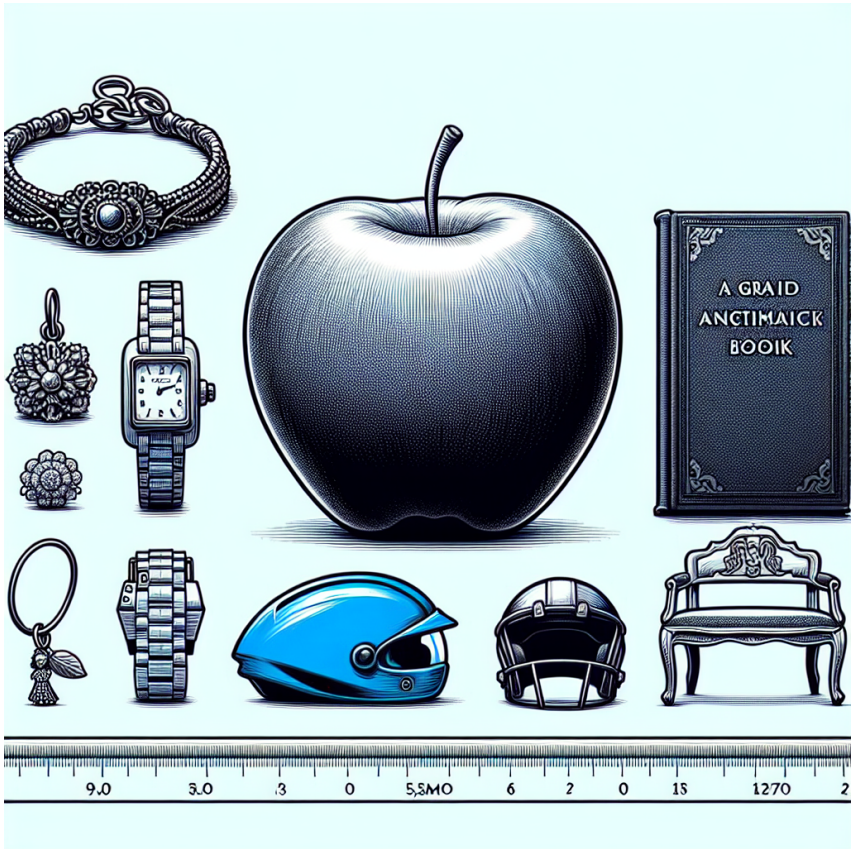


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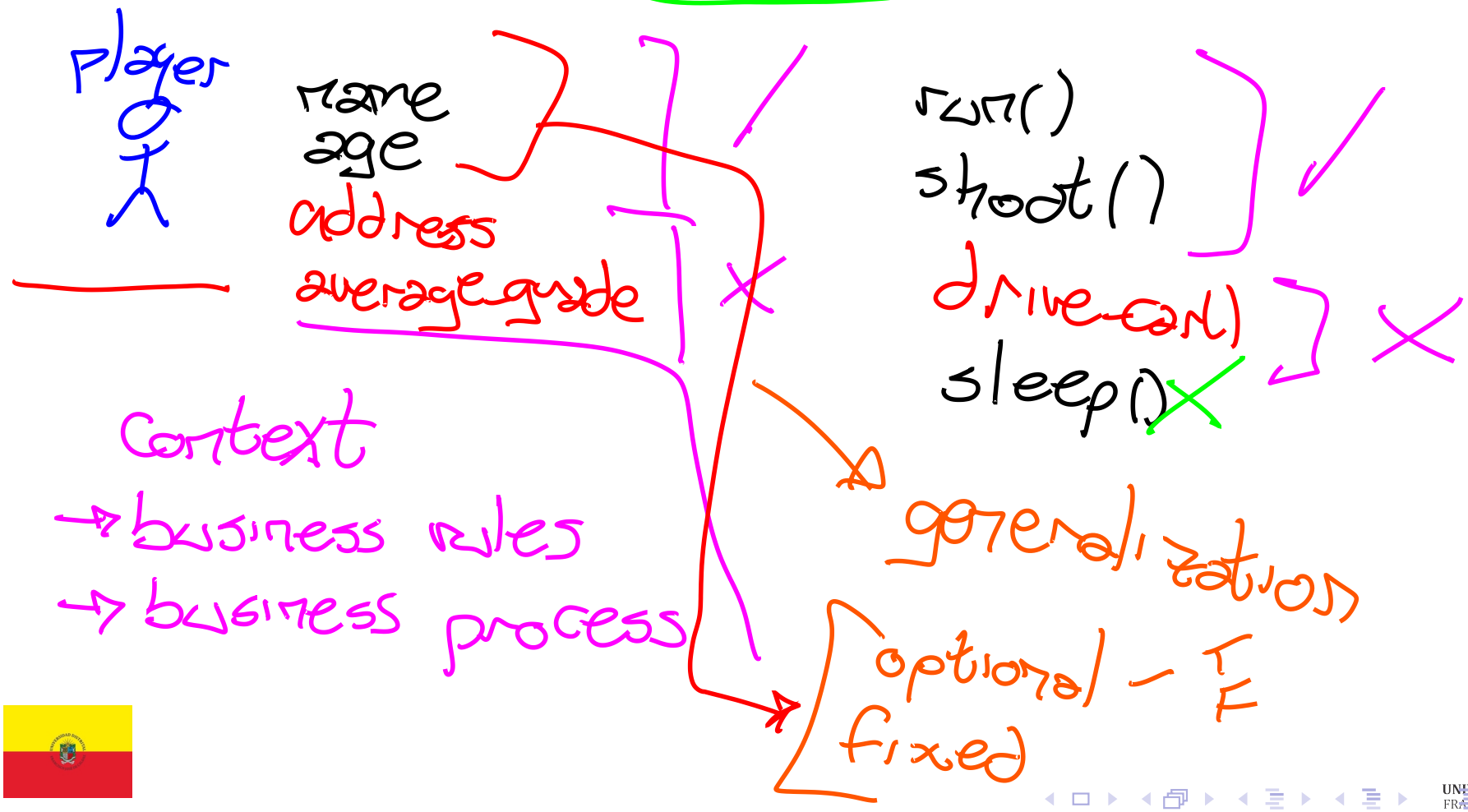
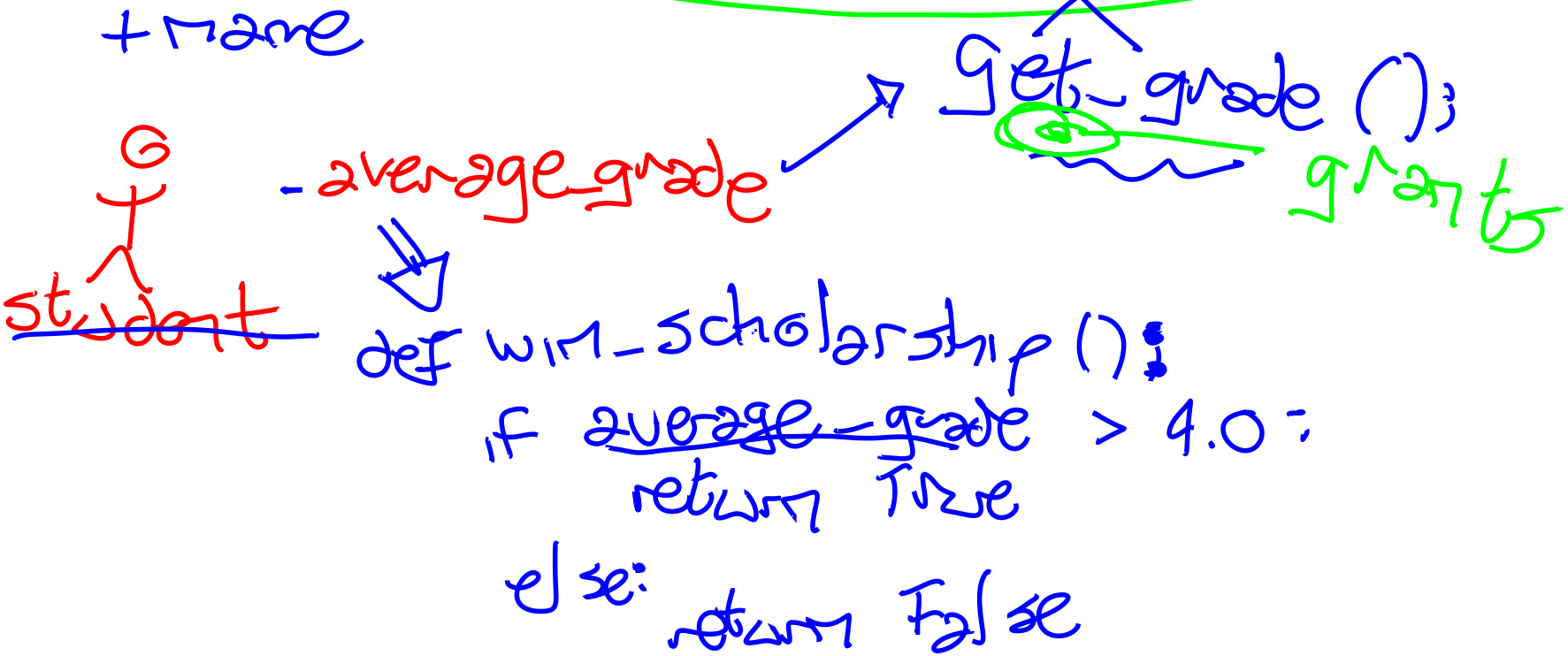
# Abstraction in OOD

Abstraction is the process of **hiding** the **complex** implementation details and showing only the necessary features of an object.



# Encapsulation in OOD

Encapsulation is the process of **hiding** the internal state of an object and requiring all interactions to be performed through an object's **methods**.

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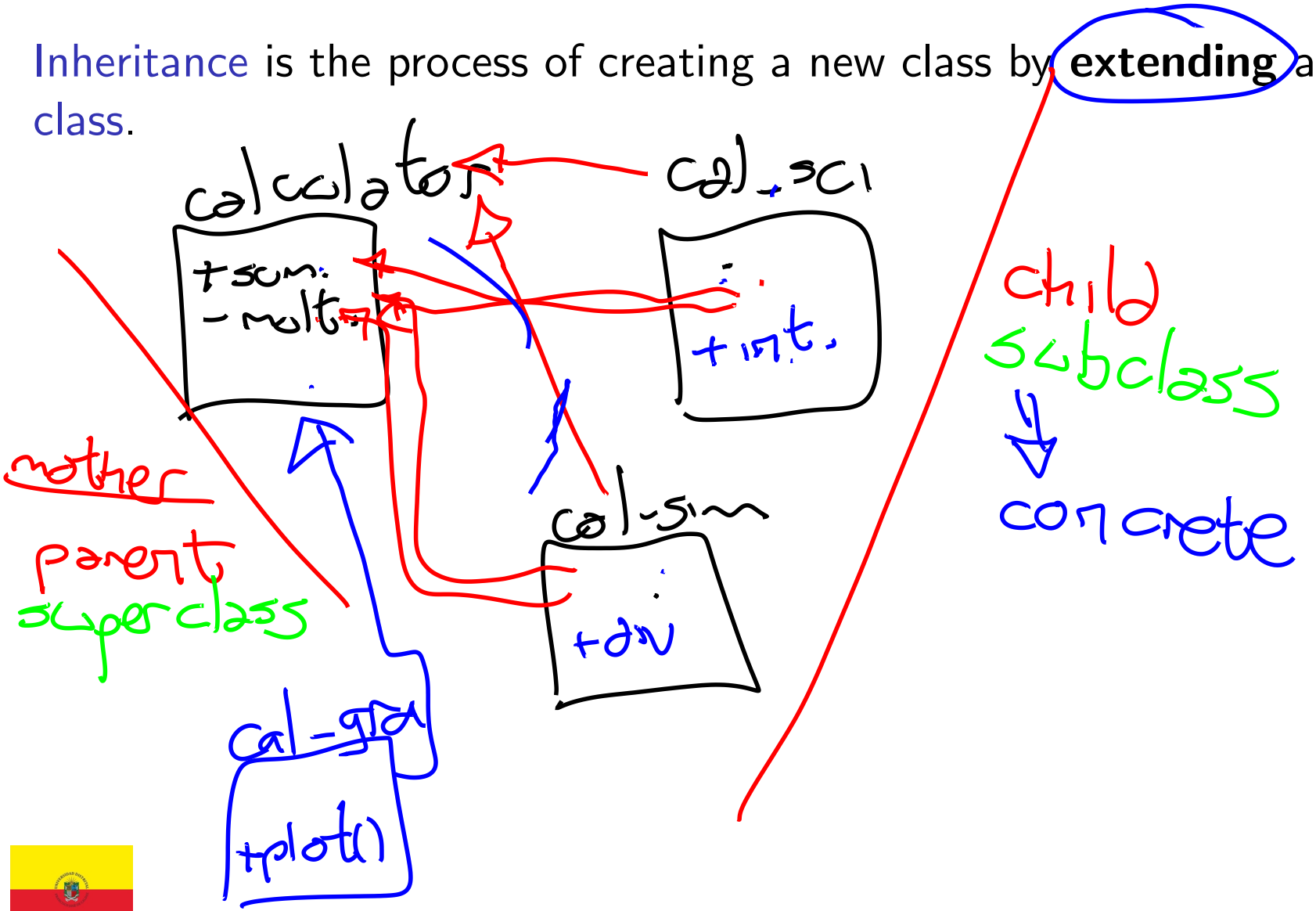
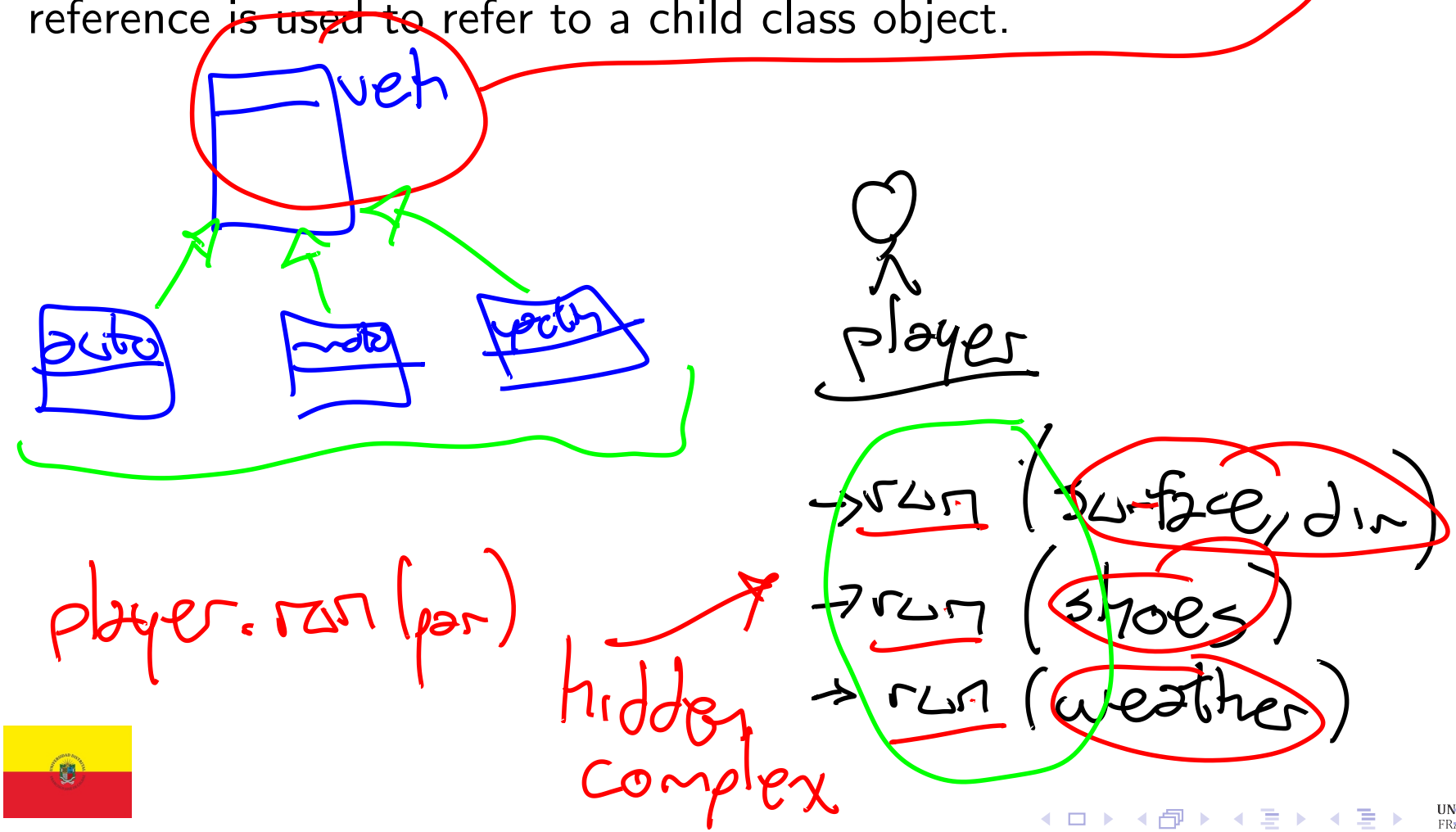
# Inheritance in OOD

Inheritance is the process of creating a new class by **extending** an existing class.



# Polymorphism in OOD

Polymorphism is the ability of an object to take on `many forms`. The most common use of polymorphism in OOP occurs when a parent class reference is used to refer to a child class object.



# Outline



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# SOLID Principles

- **Single Responsibility Principle (SRP)**: A class should have only one reason to change.
- **Open/Closed Principle (OCP)**: A class should be open for extension, but closed for modification.
- **Liskov Substitution Principle (LSP)**: Objects in a program should be replaceable with instances of their subtypes without altering the correctness of that program.
- **Interface Segregation Principle (ISP)**: A client should never be forced to implement an interface that it doesn't use or clients shouldn't be forced to depend on methods they do not use.
- **Dependency Inversion Principle (DIP)**: High-level modules should not depend on low-level modules. Both should depend on abstractions. Abstractions should not depend on details. Details should depend on abstractions.

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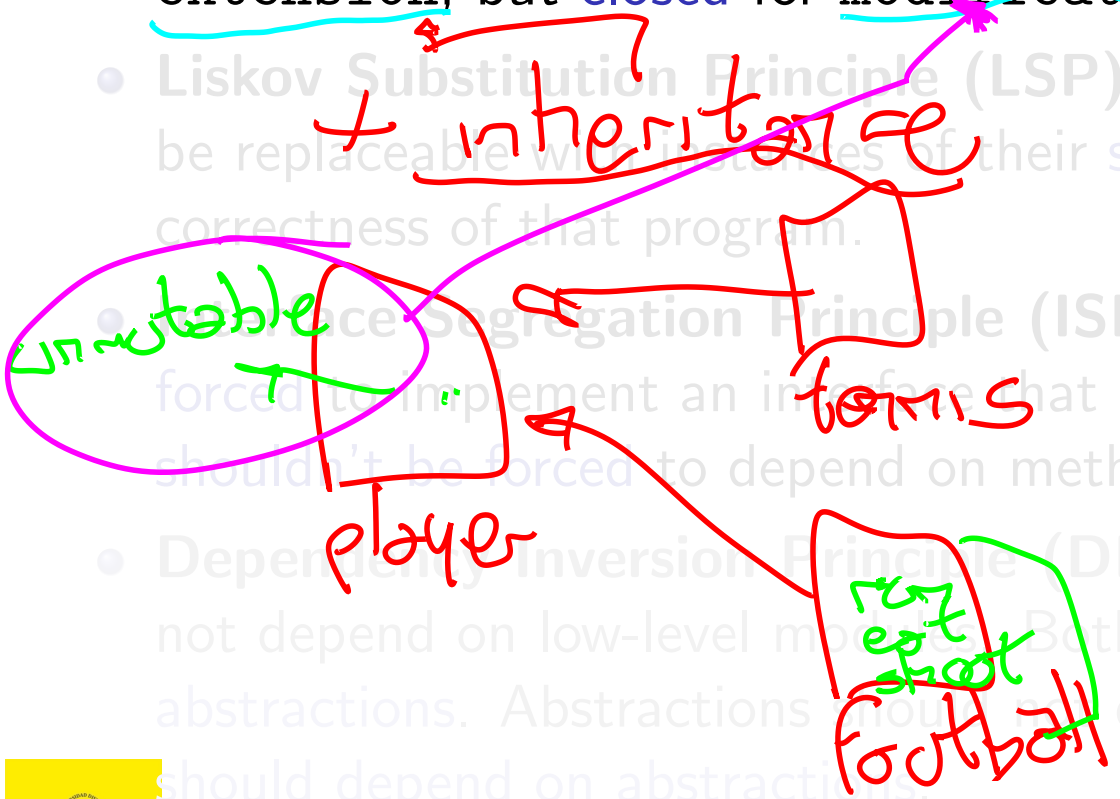

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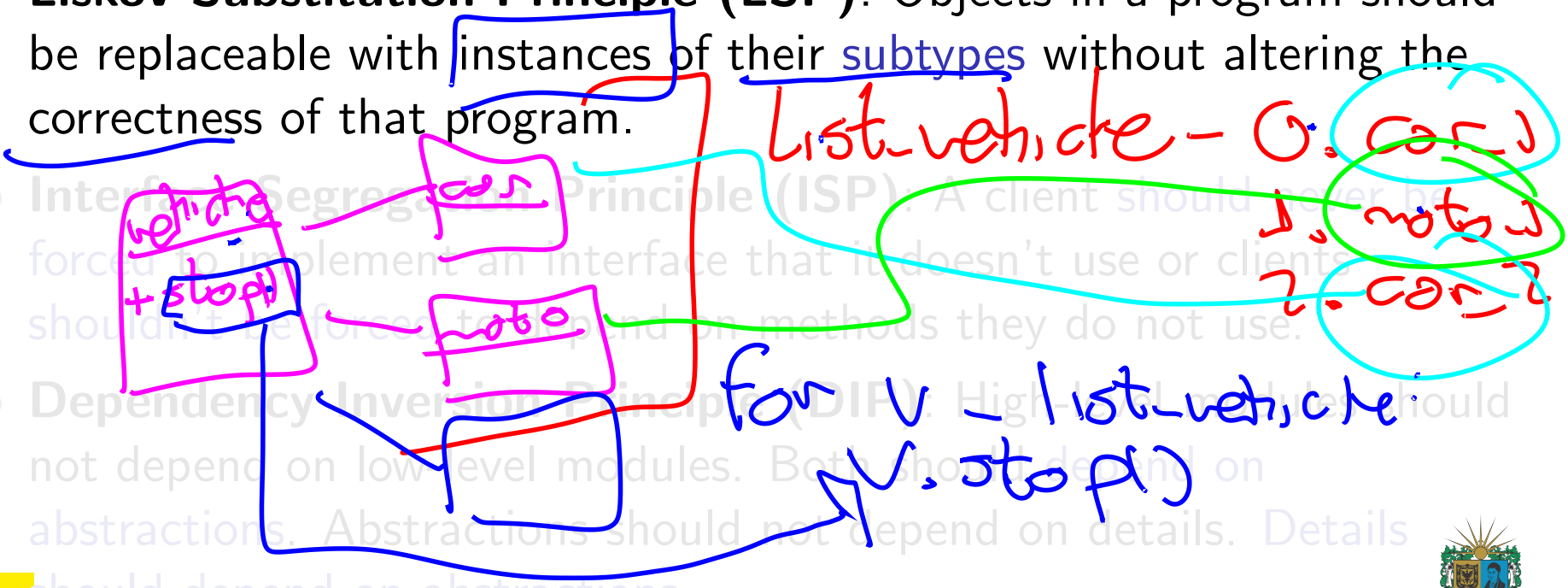

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# Good Practices

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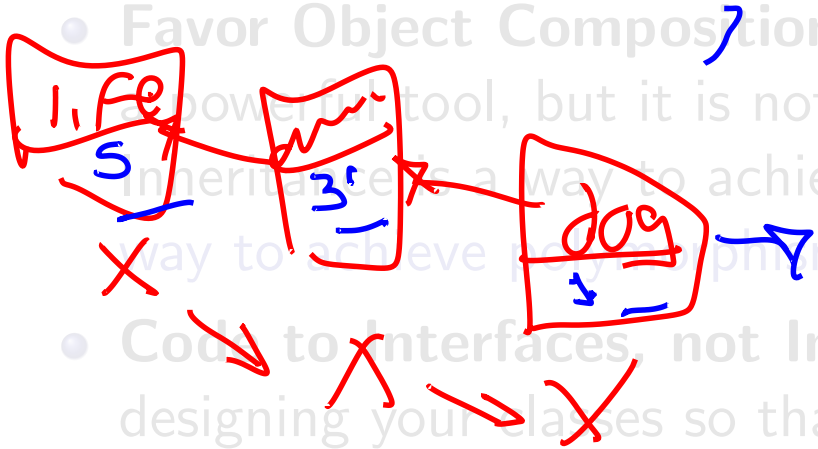


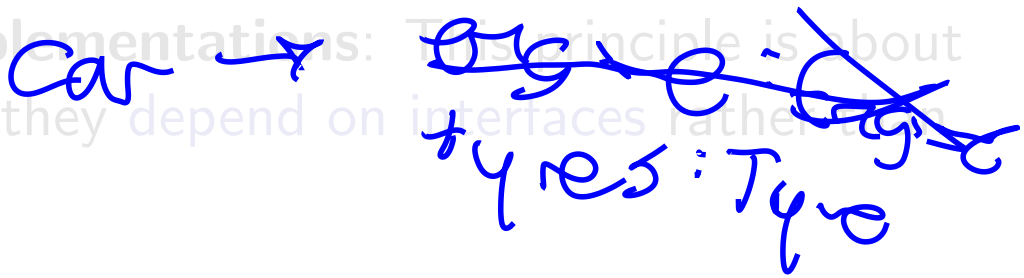


- **Favor Object Composition over Class Inheritance**: Inheritance is a powerful tool, but it is not always the best tool for the job. Inheritance is a way to achieve polymorphism, but it is not the only way to achieve polymorphism.
- **Code to Interfaces, not Implementations**: This principle is about designing your classes so that they depend on interfaces rather than concrete classes.

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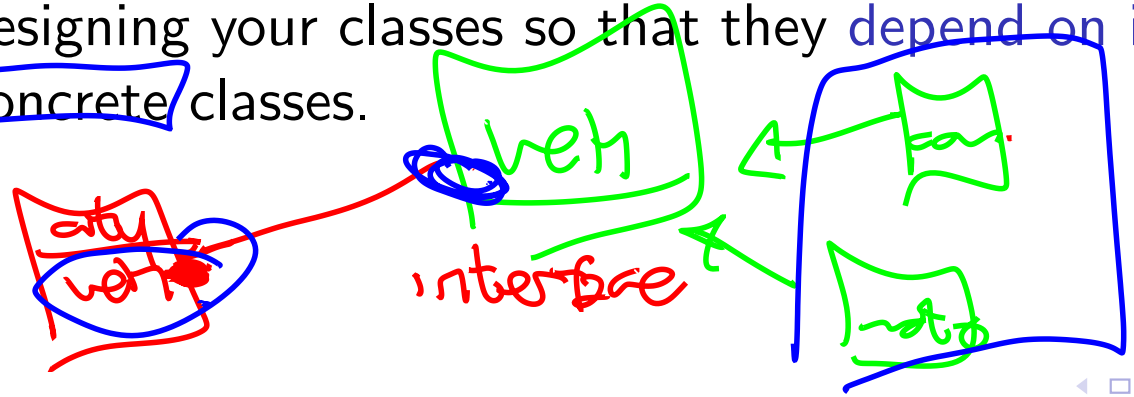

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# Modules in Python

Modules are Python files that consist of Python code. They can define functions, classes, and variables.

- **Importing Modules**: To use a module, you have to import it using the `import` statement.
- **Creating Modules**: To create a module, you just have to save the code you want in a file with the file extension `.py`.
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Packages are a way of structuring `Python's module namespace` by using *dotted module names*.

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- **Virtual Environments**: Virtual environments are a way of creating isolated environments for your **Python projects**.
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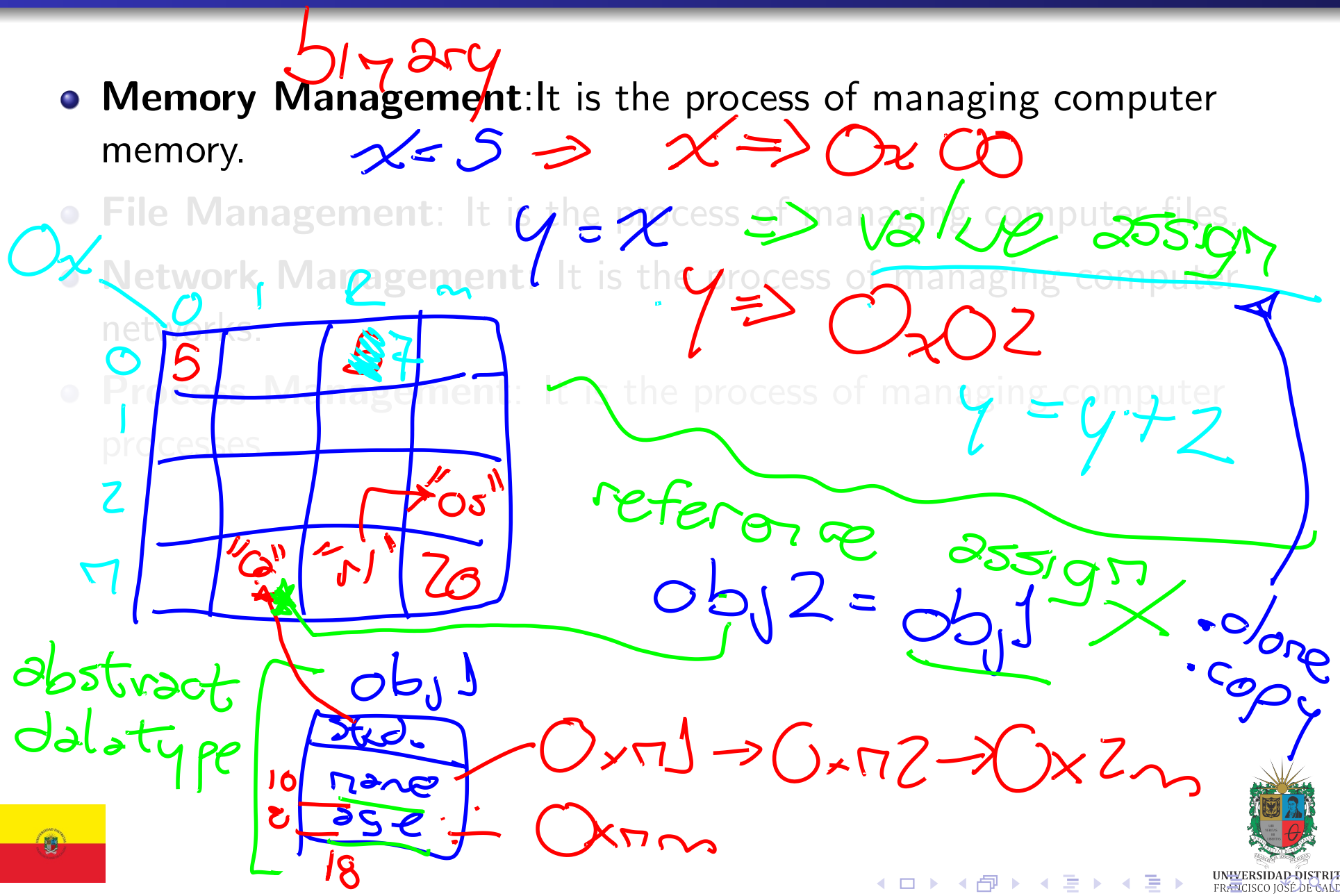
- **Memory Management**:It is the process of managing computer memory.
- **File Management**: It is the process of managing computer files.
- **Network Management**: It is the process of managing computer networks.
- **Process Management**: It is the process of managing computer processes.



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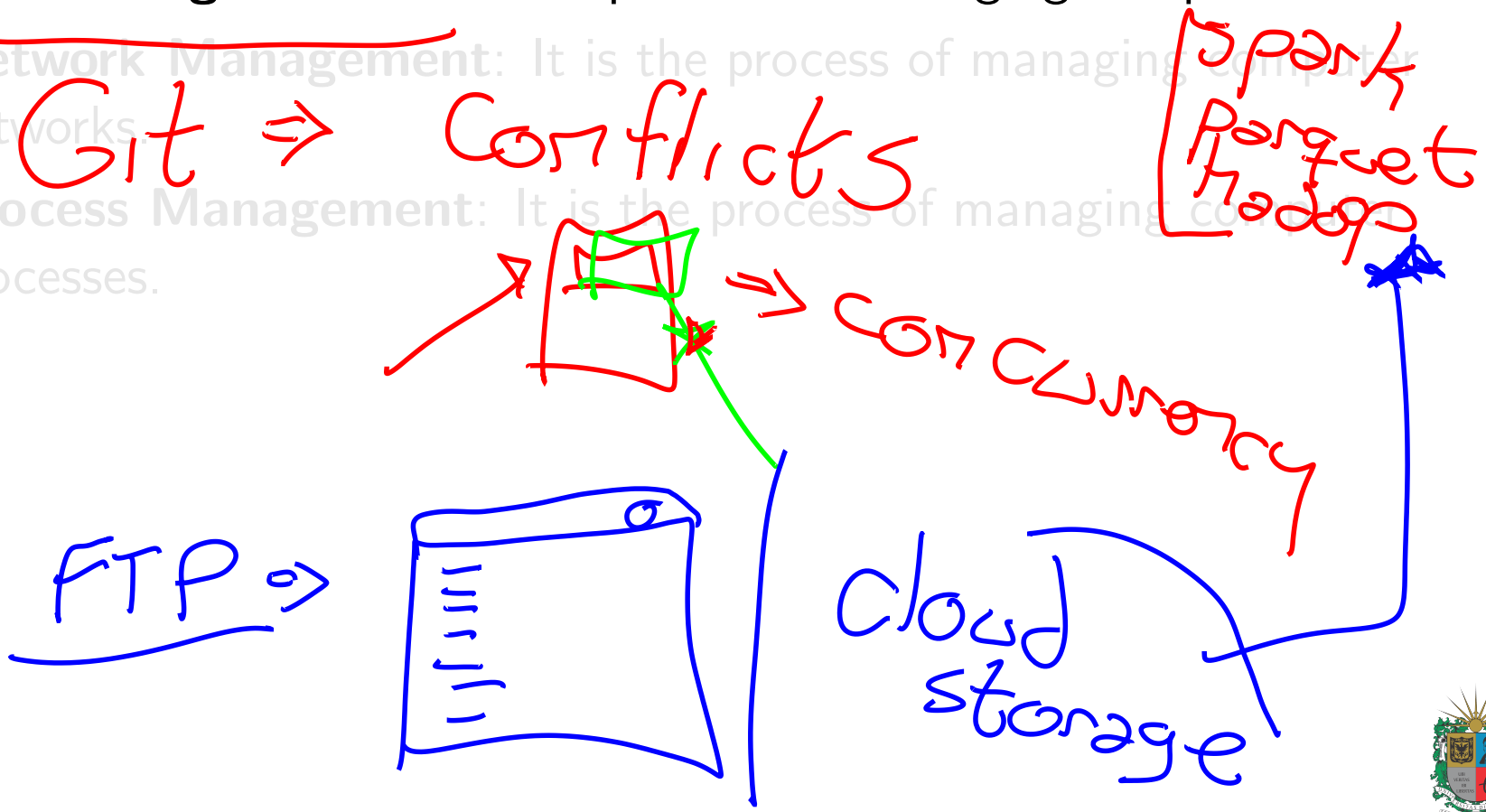

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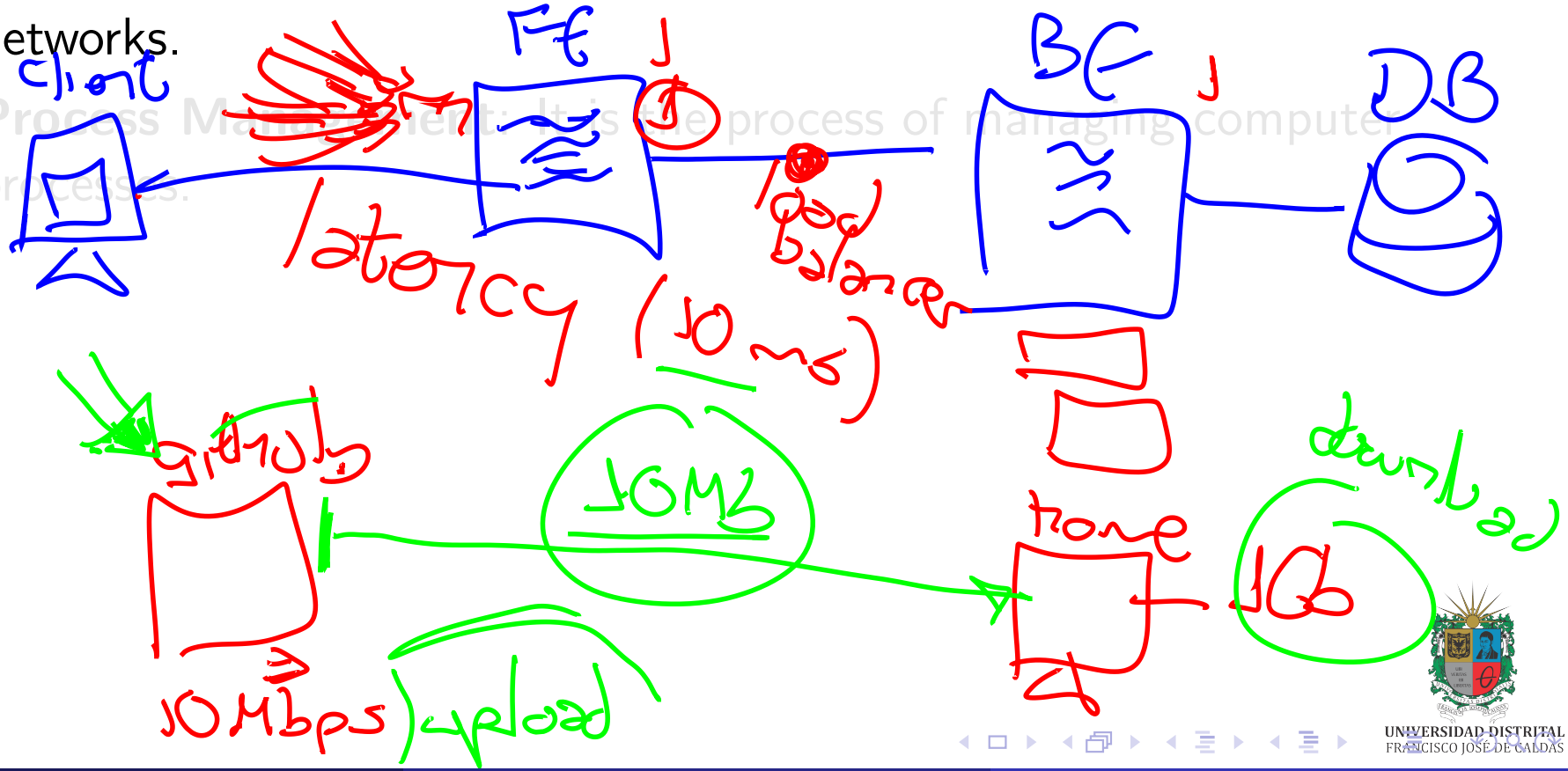

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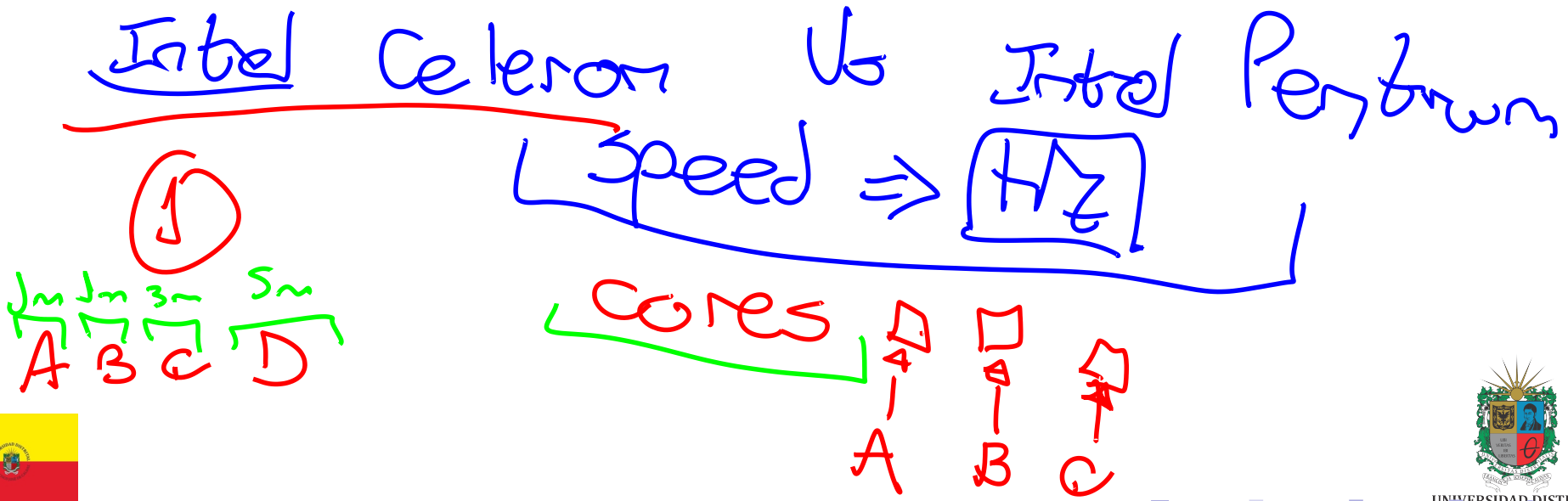

# Objects Serialization

- **Serialization**: It is the process of converting an object into a stream of bytes.
- **Deserialization**: It is the process of converting a stream of bytes into an object.
- **Pickling**: It is the process of serializing an object in Python.
- **Unpickling**: It is the process of deserializing an object in Python.
- **JSON**: It is a lightweight data-interchange format that is easy for humans to read and write and easy for machines to parse and generate.

Buffered Reader
Buffered Writer
→ file
Pickle

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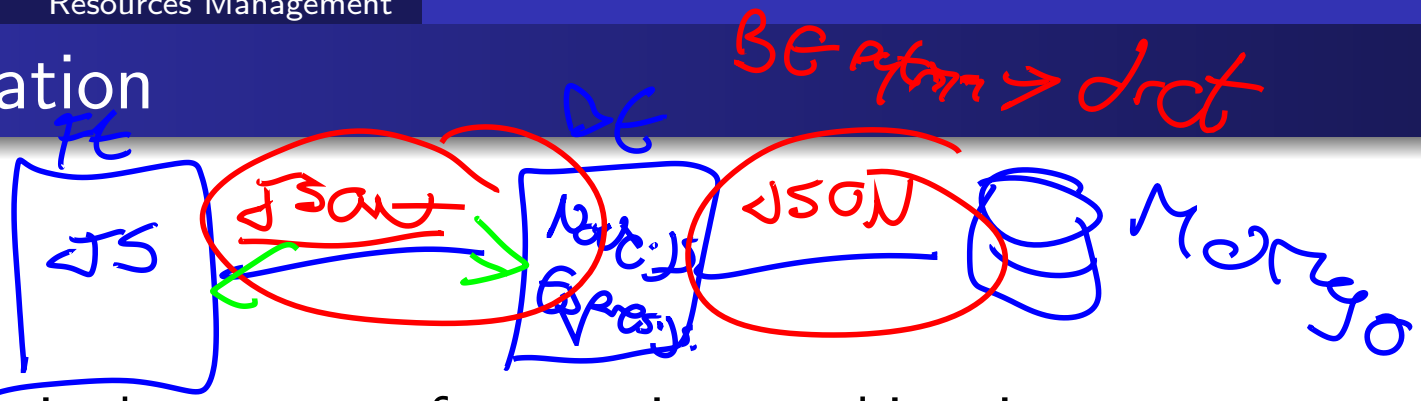


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JavaScript Object Notation

↳ Payload => Data

↳ BSON - gRPC

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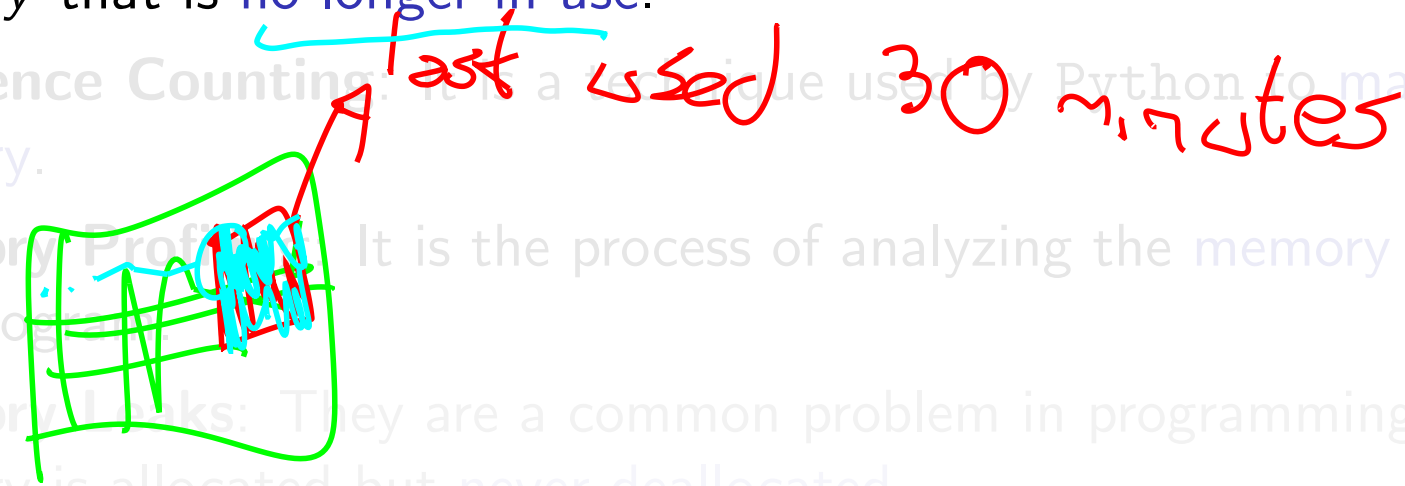
# Memory Management

- **Garbage Collection**: It is the process of automatically *reclaiming memory* that is no longer in use.




- **Reference Counting**: It is a technique used by Python to manage memory.
- **Memory Profiling**: It is the process of analyzing the memory usage of a program.
- **Memory Leaks**: They are a common problem in programming where memory is allocated but never deallocated.
- **Memory Management Tools**: There are several tools available for memory management in Python.

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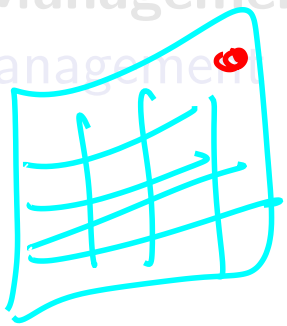

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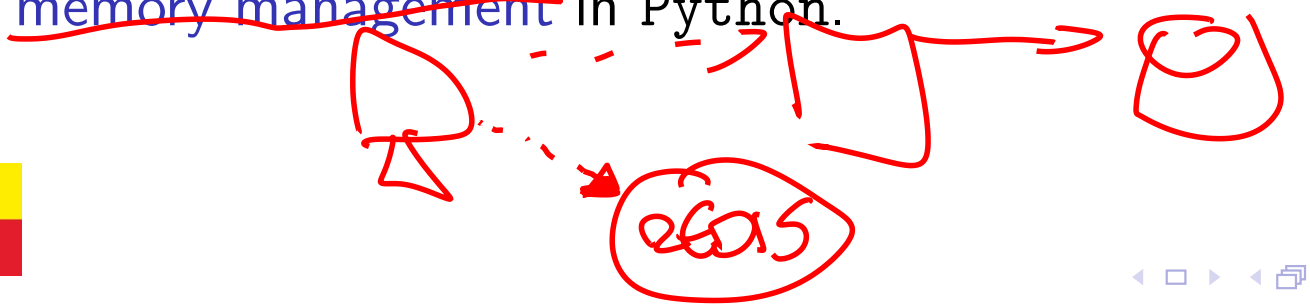
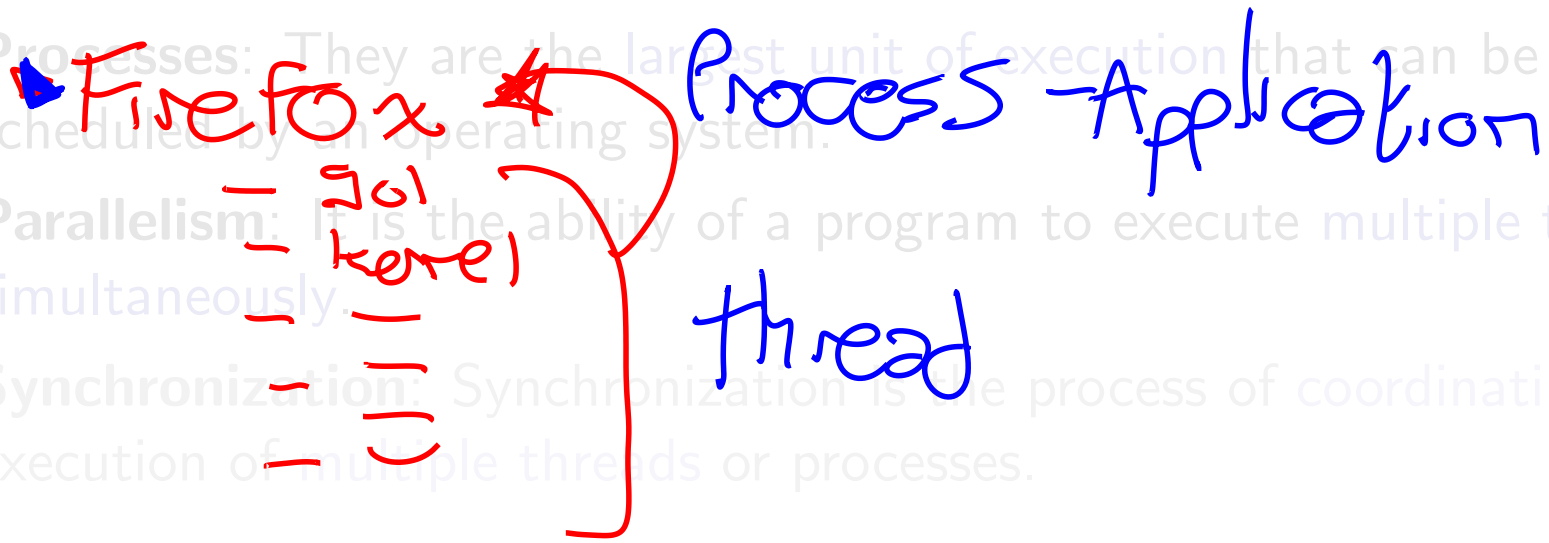


# Threds, Processes, and Concurrency

- **Threads**: They are the smallest unit of execution that can be scheduled by an operating system.
- **Processes**: They are the largest unit of execution that can be scheduled by an operating system.
- **Parallelism**: It is the ability of a program to execute multiple tasks simultaneously.
- **Synchronization**: Synchronization is the process of coordinating the execution of multiple threads or processes.

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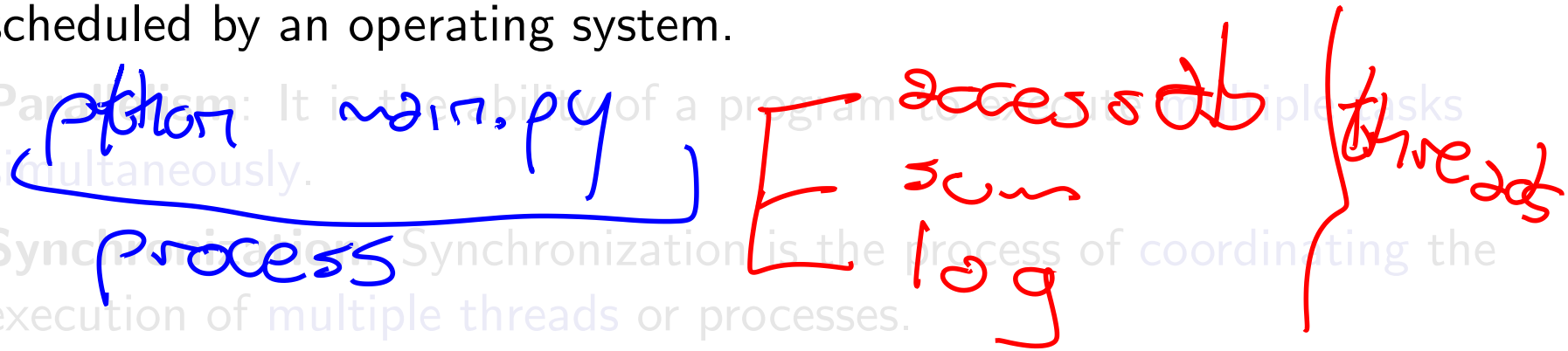


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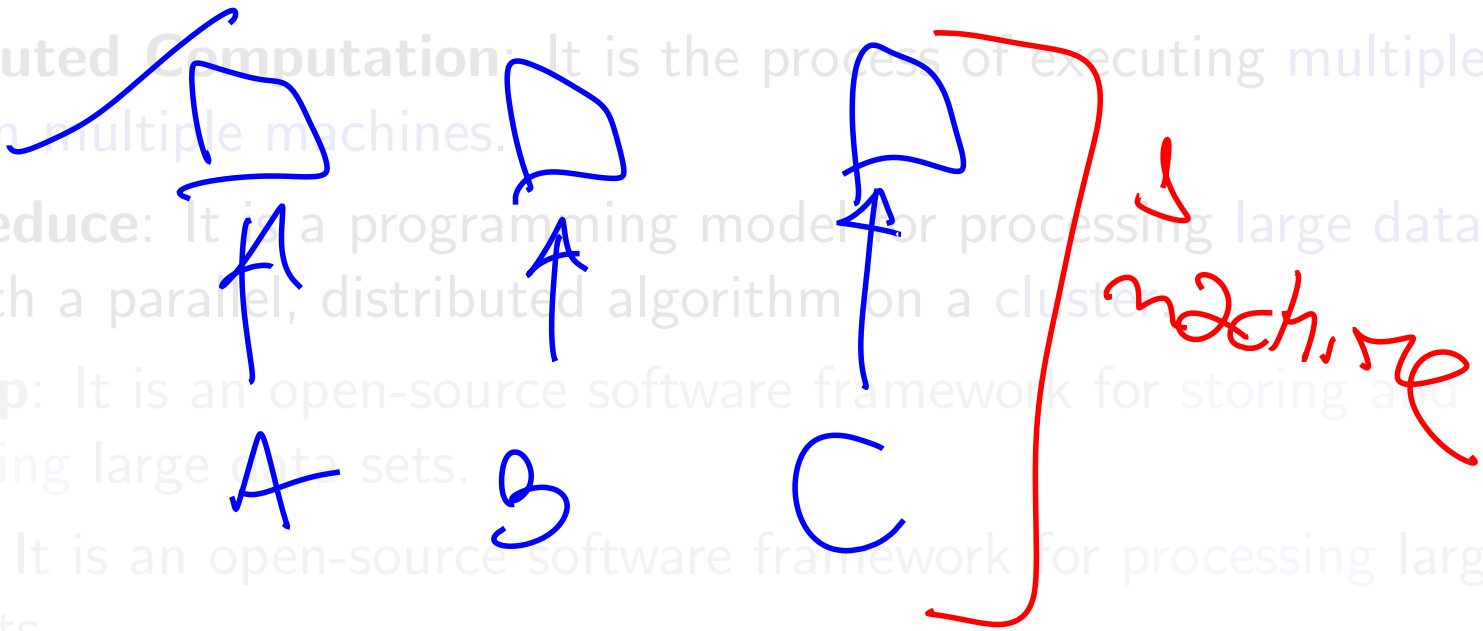


- **Distributed Computation**: It is the process of executing multiple tasks on multiple machines.
- **MapReduce**: It is a programming model for processing large data sets with a parallel, distributed algorithm on a cluster.
- **Hadoop**: It is an open-source software framework for storing and processing large data sets.
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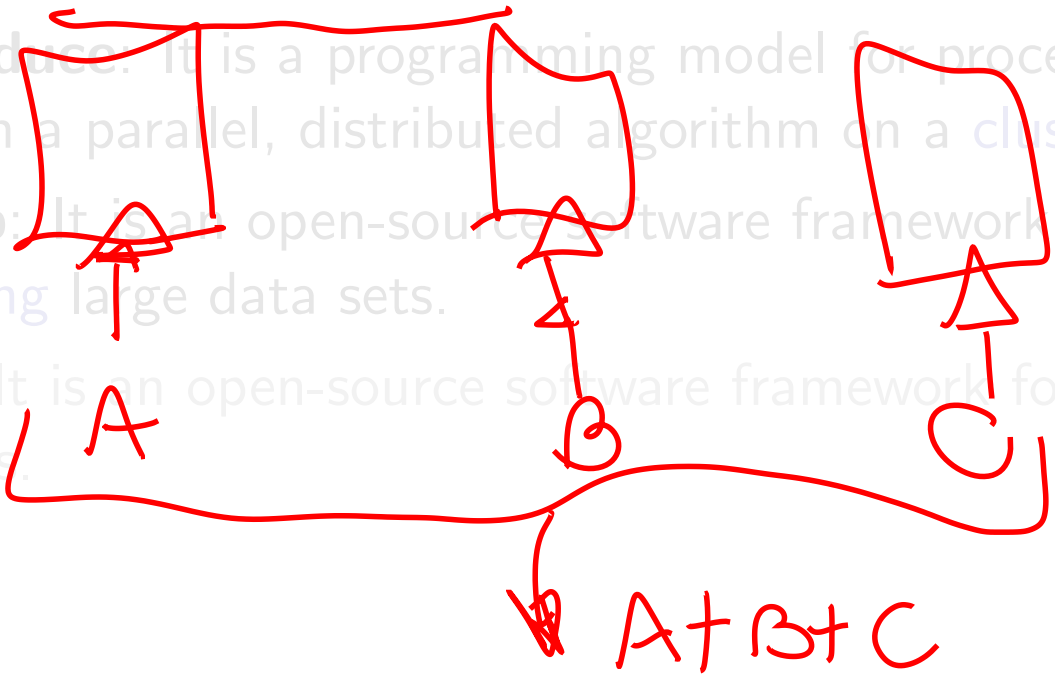

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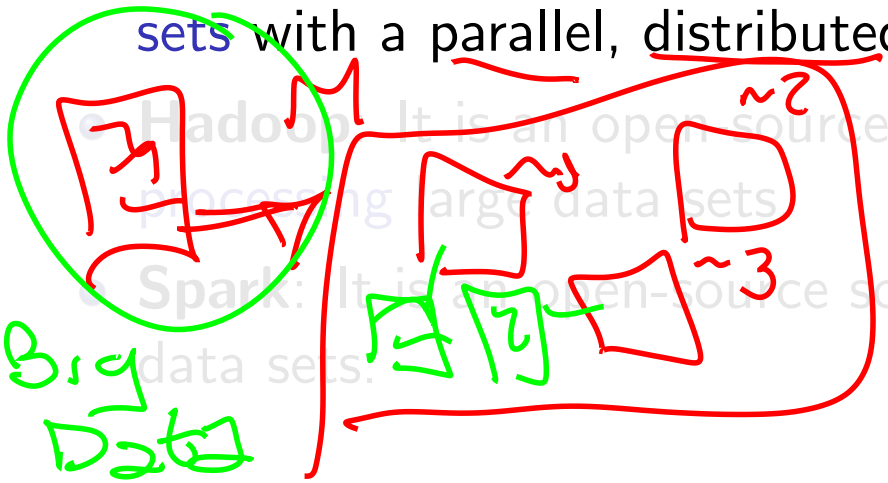


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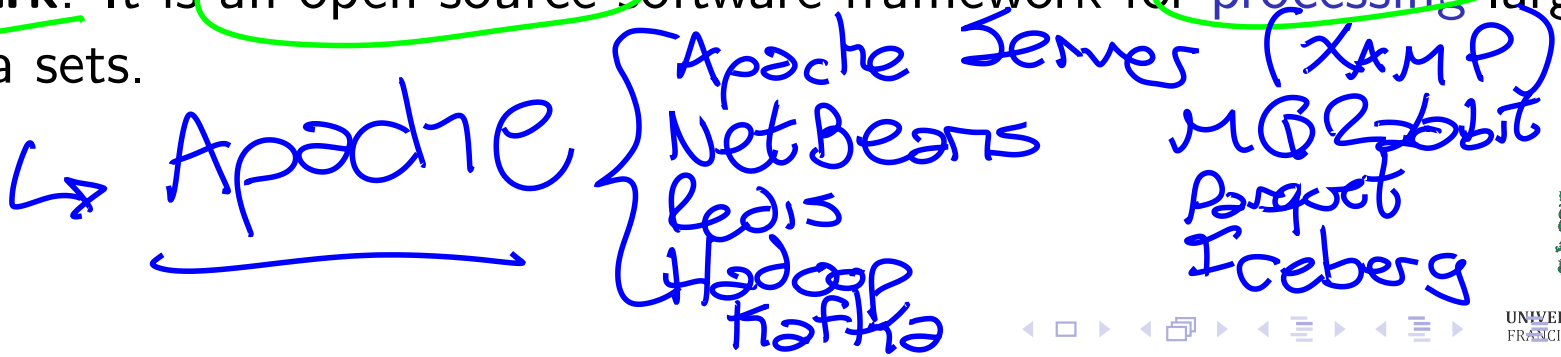

# Outline



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# Thanks!

# Questions?

Repo:
*github.com/engandres/ud-public/tree/main/courses/advanced-programming*

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