

# OBJECT-ORIENTED INTRODUCTION

## Advanced Programming

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2024-III



# Outline

1 Software Architecture

2 Object-Oriented Paradigm

3 Key Concepts



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3 Key Concepts



# Basics of Software Architecture I

- It is important to **develop** innovative and sophisticated software to provide a nice solution for end users needs.

- Software architecture brings innovation and robust structures.

Only Fans  $\Rightarrow$  Adult  
Pivot  $\rightarrow$  Content  
 $\nwarrow$  bot...  
Promote chefs  
artists

2016



Figure: Prompt: A python developer watching a building architecture draws.



# Basics of Software Architecture I

- It is important to **develop** innovative and sophisticated **software** to provide a nice **solution** for **end users needs**.

- Software architecture brings **innovation** and **robust** **structure**
- The goal of software architecture is to minimize the **designs** **to fails** **human efforts** required to build and maintain the expected system.



Figure: Prompt: A python developer watching a building architecture draws.



# Basics of Software Architecture I

- It is important to **develop** innovative and sophisticated **software** to provide a nice **solution** for **end users needs**.
- Software architecture brings **innovation** and **robust** structure.
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Figure: Prompt: A python developer watching a building architecture draws.

*- Fix bugs users  
- New features versions*



# Basics of Software Architecture II

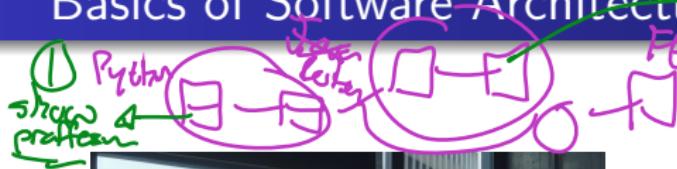


Figure: Prompt: A python developer watching a building architecture draws.



# Basics of Software Architecture II



Figure: Prompt: A python developer watching a building architecture draws.

- A software architecture is the **skeleton** for a complete **software system**. It leads the system to be **scalable, reliable, and maintainable**. Also it helps to take better **technical decisions**.
- There are some **software architecture styles**, each one with **pros/cons**, and specific use cases. However, they try to provide a **reference solution** for a **high-level structure** of a **software system**.



# Layered Architecture Pattern

The **layered architecture pattern** is a **software architecture pattern** that is widely used in the development of enterprise systems.



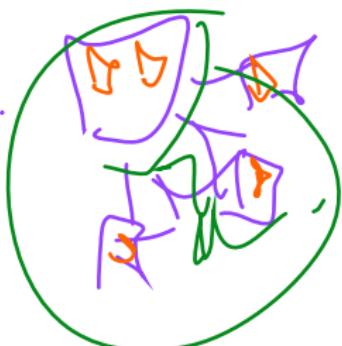
# Software Design Roles

The **software architect** is the person who is responsible for the **high-level design** of the system. He/she is the person who makes the **technical decisions** and is responsible for the **overall quality** of the system.

• (Software design)  
Software Architect → Hexa.

↳ Technical Leader  
VP of Engineering

Agile development ↗



less draws  
more code



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# Object-Oriented Paradigm I

- Object-oriented has become one of the most traditional and popular paradigms in software development.

→ Binary  $\Rightarrow$  Assembly  
→ Procedural  
→ High-level (natural language)  
properties,  $\Rightarrow$  C / C++ ...  
form of procedures (often known as methods)  
→ Loop  $\Rightarrow$  Object reuse code



Figure: Prompt: Draw several objects sorted by size.

# Object-Oriented Paradigm 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** ~~data?~~ (often known as *attributes* or *properties*), and code, in the form of **procedures** (often known as *methods*). *Process*



Figure: Prompt: Draw several objects sorted by size.



# Object-Oriented Paradigm II



Figure: Prompt: Draw several objects sorted by size.



- The idea is to design a **system modularly**, and to make it easier to **maintain** and to **understand**. Also the idea is to emphasize the **reuse of code**.



# Object-Oriented Paradigm II



**Figure:** Prompt: Draw several objects sorted by size.



- 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:

- Encapsulation
- Abstraction
- Inheritance
- Polymorphism

# Object-Oriented Paradigm II



Figure: Prompt: Draw several objects sorted by size.



security validation

value validation

getters

& setters

- 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:

- Encapsulation

Private attributes

Abstraction  
Inheritance  
Polymorphism  
Hide information

- Abstraction
- Inheritance
- Polymorphism

method

manipulate  
attribute  
calculable

black box

# Object-Oriented Paradigm II



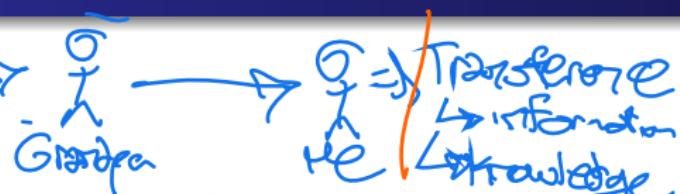
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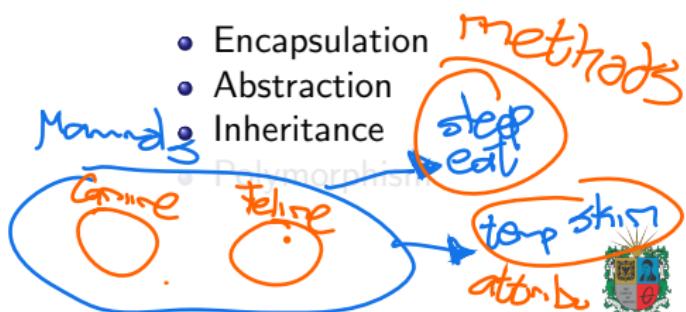
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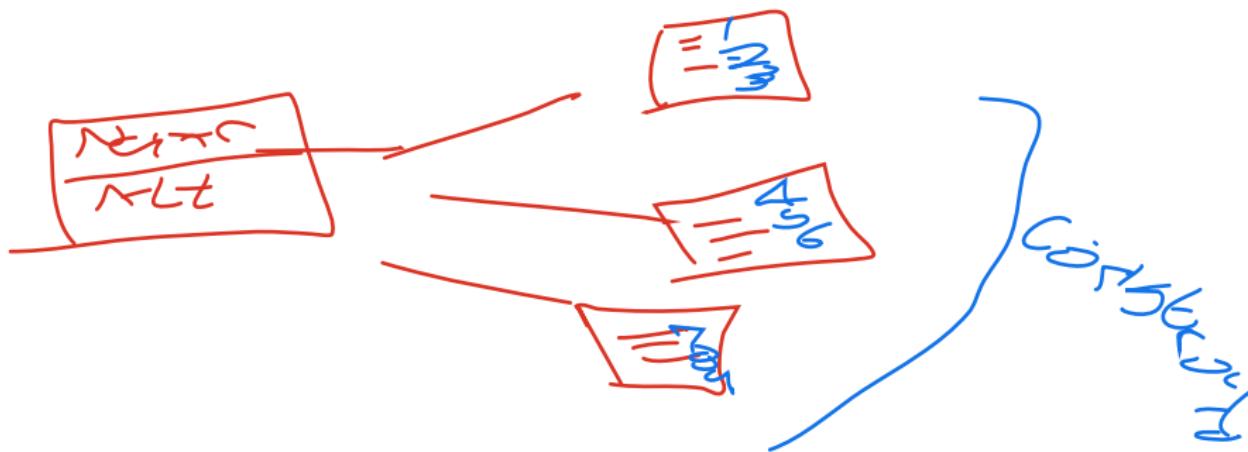


Figure: Prompt: Draw several objects sorted by size.



# What is a class?

A **class** is a **blueprint** for creating objects (a particular **data structure**), providing **initial values for state** (member variables or attributes), and implementations of **behavior** (member functions or methods).



# Why Objects?

- Objects are a **natural** way to model the **real world**.
- Objects are **modular**, and can be **reused**. Also they can be **extended**.

Iteration



books  
books  
truck  
factory  
client



# Why not Objects?

- Objects are **complex** to understand and to design in big systems.
- Objects are **expensive** in terms of memory and processing.
- Objects sometimes are **difficult** to test.

*↓  
unit test - redic  
↓  
test cases*



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1 Software Architecture

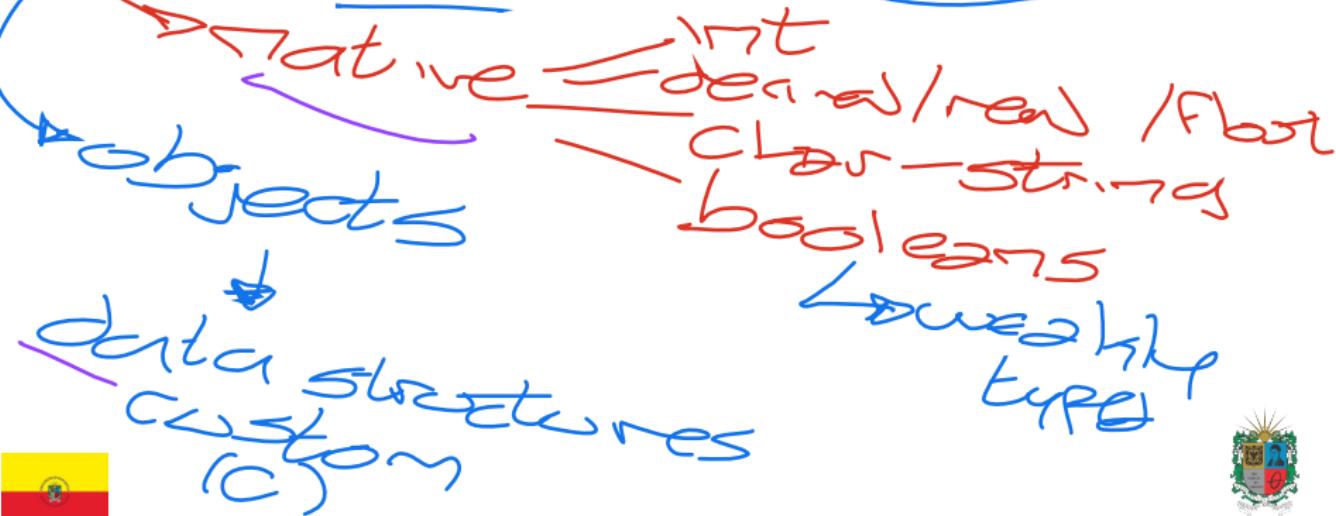
2 Object-Oriented Paradigm

3 Key Concepts



# Data Types and Abstract Data Types

- A **data type** is a **classification** that specifies which type of **value** a variable can hold.
- An **abstract data type** is a **mathematical model** for a certain class of data structures that have **similar behavior**. It is a **data type** that is defined by its **behavior** from the point of view of a user.



# Behaviours: Methods and Functions

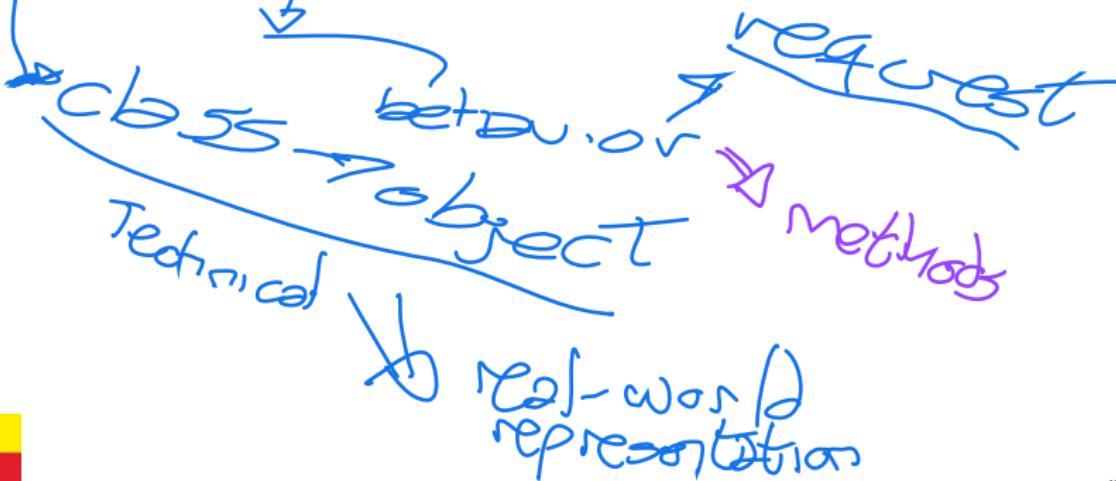
- A **function** is a **procedure** that is defined outside of a **class**.
- A **method** is a **function** that is **associated with a class**. It is a **procedure** that has access to the **object** and its **data**.

object → actions  
behavior  
↳  
algorithm



# Entities and Duties

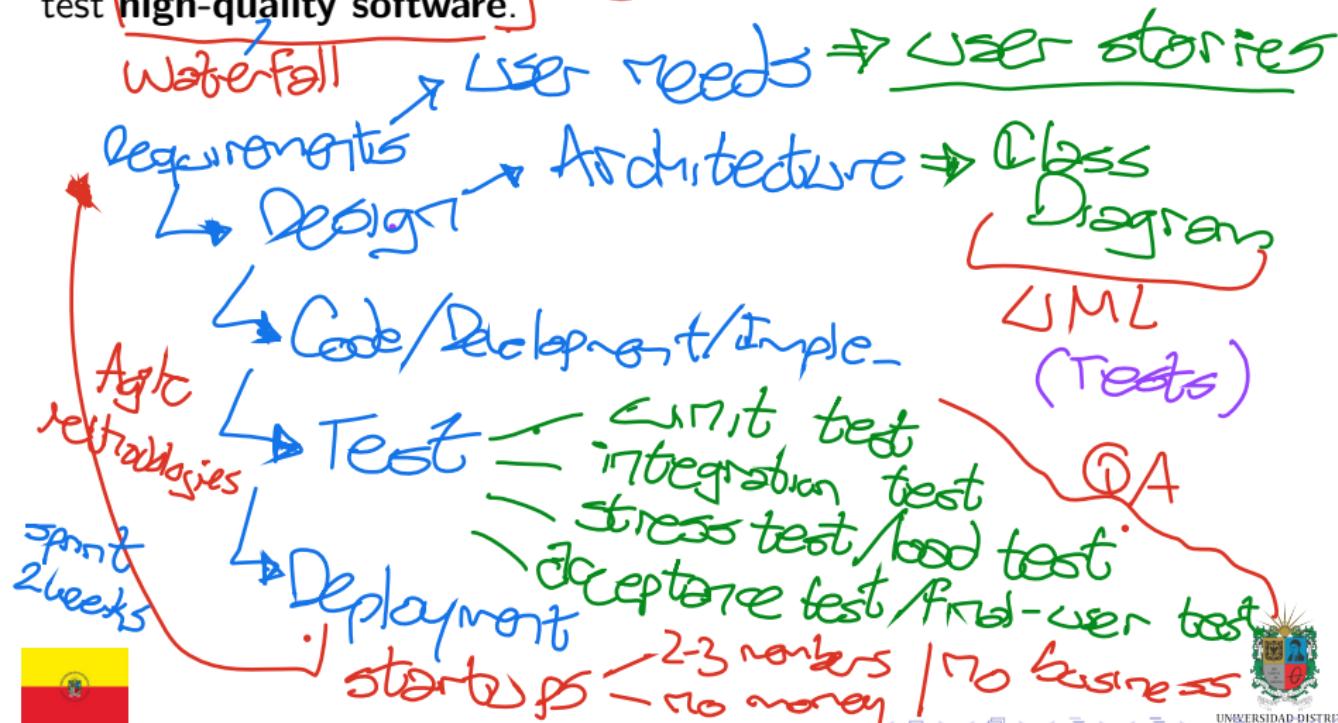
- An **entity** is a **thing** that exists in the **real world** and can be **distinguished** from other things.
- A **duty** is a **task** that **someone** is required to perform.
- In **object-oriented programming**, an **entity** is an **object** and a **duty** is a **method**.



# Software Life Cycle

Legacy

The software life cycle is a **process** that is used to design, develop, and test **high-quality software**.



# Code Review, Pair Programming, and Linters

- A **code review** is a **systematic examination** of **computer source code**.

- Pair programming is an agile software development technique in which two programmers **code** together at one workstation.
- A **lint** is a **tool** that is used to analyze **source code** and flag **programming errors, bugs, stylistic errors, and suspicious constructs**.



# Code Review, Pair Programming, and Linters

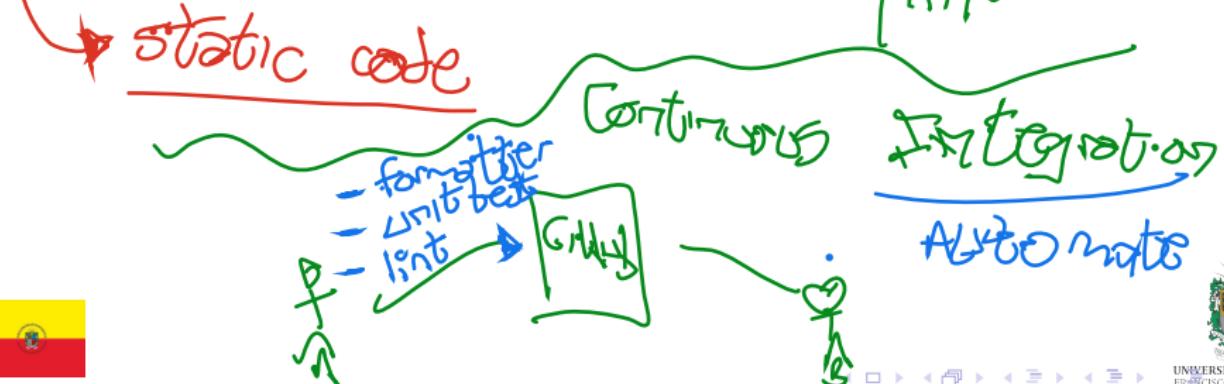
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↳ PyLint



# Unit Testing and Test-Driven Development

- Unit testing is a **software testing method** by which individual units of source code are tested to determine whether they are fit for use.
- Test-driven development is a **software development process** that relies on the repetition of a very short development cycle.

assert  $\text{sum2}(2, 2) == 4$

assert  $\text{sum}(9 \times 10^9, 9 \times 10^9) == 9 \times 10^{10}$

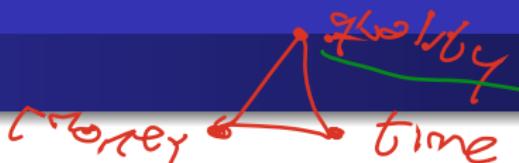
assert  $\text{sum}("a", 1) == "ERROR"$

edge case

`static int sum2(int a, int b){  
 return a+b;}`



# Software Quality and Metrics



- Software quality is a field of study and practice that describes the desirable attributes of software products.
- Software metrics are a measure of some property of a piece of software or its specifications.

→ Code lines per method → Complex x

→ Scalability → multiple responsibility

→ Errors / Code lines



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# Thanks!

## Questions?



Repo: <https://github.com/EngAndres/ud-public/tree/main/courses/advanced-programming>

