Object-Oriented Modelling

Object-Oriented Programming

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2025-III

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Outline

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Design Before Code

- **Design** should come before coding.
- Jumping into *code without a plan* leads to confusion and rework.
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Object-Oriented Approach

- The **object-oriented approach** models the system as a collection of interacting objects.
- Each `object represents` a real-world entity or concept.
- **Objects** encapsulate data and behavior.

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Conceptual Design and Technical Design

- **Conceptual Design**: What the system should do, using `high-level models`.
- **Technical Design**: How the system will be implemented, using `detailed diagrams` and specifications.
- Both are essential for a successful software project.

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- Includes requirements, design diagrams, user manuals, and code comments.
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Talk with Machines: Programming Paradigms

- **Programming languages** are tools to communicate with machines.
- **Paradigms**: `Imperative`, `Procedural`, `Object-Oriented`, `Functional`, `Logic`.
- Each paradigm offers a *different way to think* about and solve problems.

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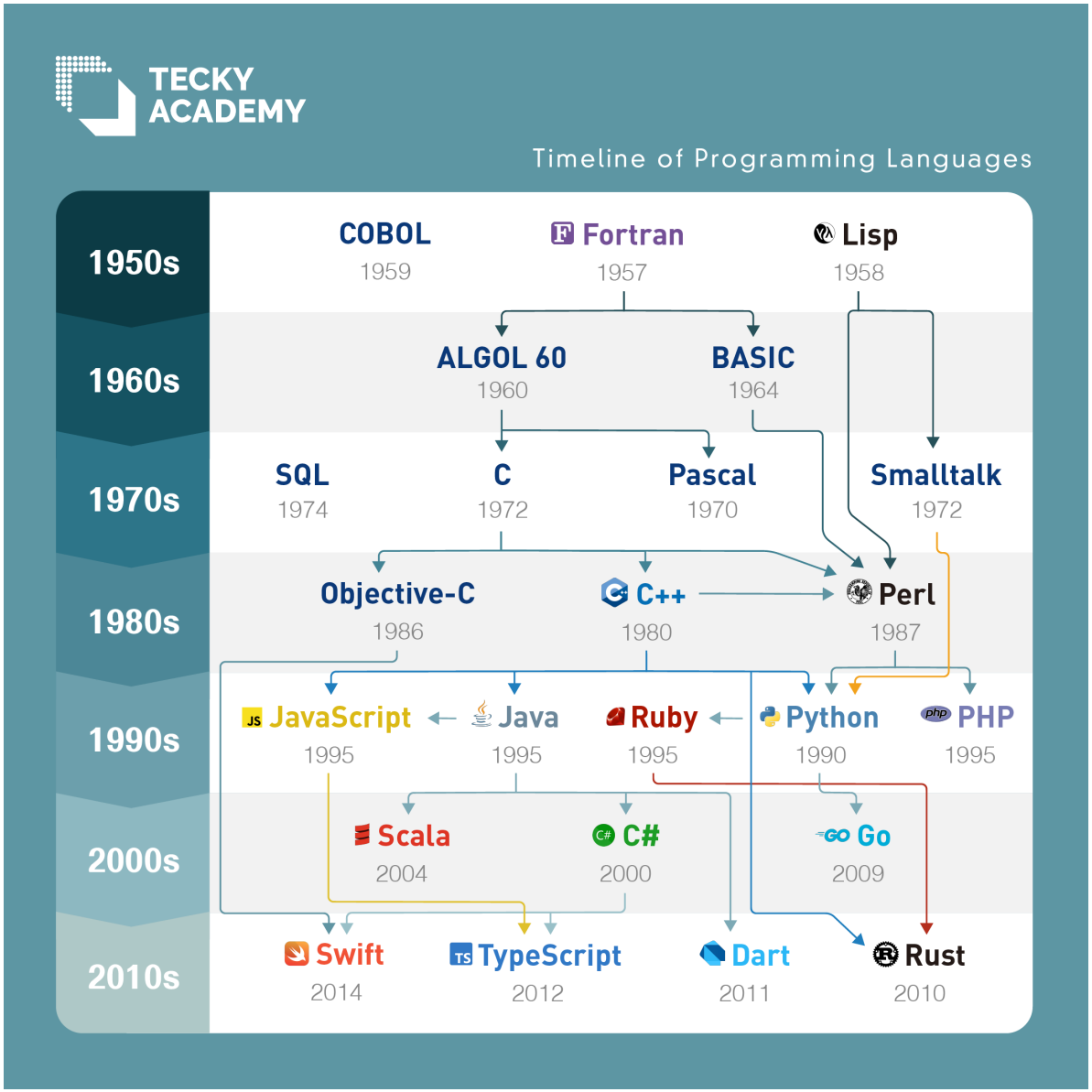
History of Programming Languages



Strategies to Solve Problems

- **Top-Down**: Start from the big picture and break it down into smaller parts.
- **Bottom-Up**: Start from small, well-defined components and integrate them into a complete system.
- Both strategies are useful and often *combined* in `software design`.

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Object-Oriented Design and Contracts

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- **Contracts**: Define responsibilities and expectations between objects.
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- Common diagrams: `Class diagrams`, `Sequence diagrams`, and `Use case diagrams`.
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Abstraction

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- **Rule of Least Astonishment**: Design so users are not surprised by behavior.
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Abstraction & CRC Cards

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- Expose only what is necessary (*access levels*: `public`, `private`, `protected`).
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Encapsulation & UML

Black Box Thinking

- **Objects communicate** through well-defined interfaces.
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- **Black box**: Focus on what an object does, not how it does it.

Demo time!

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Data Integrity: Getters and Setters

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- They help maintain data integrity by controlling how attributes are accessed and modified.
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Decomposition

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- **Separation of Concerns**: Each part should have a clear responsibility.
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Decomposition Example: Kitchen in a House

Association

A **relationship** between two classes where one class uses or interacts with another class.

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Aggregation

An **aggregation** is a **whole-part relationship** where one class is a part of another class, but can exist independently.

Demo time!

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Generalization

- **Generalization** eliminates redundancy by extracting common features.
- **D.R.Y. Principle**: Don't Repeat Yourself.
- `Behaviors` can be generalized using **inheritance**, interface inheritance, and abstract classes.
- **Polymorphism**: Objects can be treated as instances of their parent class.
- **Types of inheritance**: `single`, `multiple`, `interface-based`.

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- **Derived class**: The class that inherits from the base class.
- **Benefits**: Code reusability, easier maintenance, and polymorphism.
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Inheritance & UML

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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.
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Good Practices

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- **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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Thanks!

Questions?

Repo: *https://github.com/EngAndres/ud-public/tree/main/courses/object-oriented-programming*

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