Object Oriented Programming

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Why OOP?

- One of the most widely used programming paradigm
- Why is it used?
  - Well suited for building trivial and complex applications
  - Code re-use
    - More productivity
  - Adding new features is simple
  - Less production and maintenance cost
- C++ / Java / C#

OOP building blocks

- Objects models a:
  - Real world object (computer, clock, microwave, book, box)
  - Concept (meeting, telegram group)
  - Process (algorithm, learning models)
- Classes
  - Prototype or blueprint
  - We can create objects from classes
  - We define classes and make objects from them

OOP building blocks

- Class:
  - Attributes or properties
  - Behavior or actions
    - Method
- Objects
  - Data (value for each attribute)
    - Stored in variables
  - Actions
  - Has an identity

Real world example (car)

Class: Car

Attributes:
Color, Model, 0-100, max Speed
Methods:
Start, Accelerate, Reverse, Stop

Object: Sipa131

Attributes:
White, 131, 14.5 s, 170 km/h
Methods:
Start, Accelerate, Reverse, Stop

Object: Tesla Model X

Attributes:
Red, Model X, 2.9 s, 250 km/h
Methods:
Start, Accelerate, Reverse, Stop

Real world example (Person)

Class: Person

Attributes:
Name, Height, Age
Methods:
Speak, Listen, Eat, Run, Walk, …

Object: Person1

Attributes:
Shahab, 174, 24
Methods:
Speak, Listen, Eat, Run, Walk

Object: Person2

Attributes:
Simin, 176, 21
Methods:
Speak, Listen, Eat, Run, Walk

Class

- Set of variables
  - To represent attributes
- Set of functions
  - To describe behavior
  - Acts on class variables

Object

- Instance of a class
- Holds data
  - Data are in RAM
- Data can be accessed by its fuction

What Is OOP

- Paradigm for problem solving
  - Interaction among objects
  - Follows a natural way of solving problems
    - Mohammad wants to start his car

OOP concepts

- Abstraction
- Encapsulation
- Inheritance
- Polymorphism

Abstraction

- Essential properties and behavior
- Abstract class
- Example:
  - Blind date
    - Include all information to recognize
    - Don't tell any other data
  - Make coffee
    - + How to use your coffee machine
    - - How it makes coffee
- Data hiding

Encapsulation

- Combines data and functions
  - Functions manipulate data
  - Make them into single unit
- Object and class enforce encapsulation
- Example:
  - Microwave:
    - Power
    - Change power
    - Rotation

Inheritance

- Create new classes from existing classes
  - New class: derived class
  - Existing class: base class
- Inherit variables and functions
- Re-use existing code
- Has a
- Is a

Inheritance

- Example:
  - Person
    - Employee
    - Customer
  - Pet
    - Dog
    - Cat
  - Shape
    - Rectangle
      - Square
    - Triangle
    - Circle

Polymorphism

- Perform different things according to its object class
- Code for abstract class
- Run for its instance
- Example:
  - Shape
    - Rectangle
      - Square
    - Triangle
    - Circle
  - Draw shape

Advantages of OOP

- Build program from standard working modules
  - Less development time and higher productivity
- Divide and conquer
  - Easy to partition the work
- Easy to upgrade from small to large
- Multiple instances without interference
- Data hiding and more secure programs
- Less redundant code

Disadvantages of OOP

- Much more lines of code
  - Slower execution
- Cant be used everywhere
  - Its not universal language
  - Only applied when it is required
  - Not for all types of problems
- A little bit tricky
  - Design skill, programming skill, proper planning
- It takes time to get used to