



NYU

Courant Institute of Mathematical Sciences
Department of Computer Science
CS101 Introduction to Computer Science

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Chapter#9: Introduction to the Object Oriented Programming Paradigm



Objectives

- ❖ Introducing the motivation behind the creation of the object oriented paradigm
- ❖ Learning the concept of the class, object (state, behavior and identity), and abstraction
- ❖ Differentiating between the procedural programming paradigm and the object oriented programming paradigm
- ❖ The benefits of using the object oriented paradigm
- ❖ Introducing object, classes, constructors, getters, setters, member variables.. by designing a Phone book directory using the Object Oriented Programming

The Phone Book Problem..

- We want to represent a phone book using Java (using up to what we covered so far - methods)
- Each entry has:
 - First Name
 - Last Name
 - Phone number
 - Address
- Let us brainstorm – Can we use arrays, methods? variables? ..

Question

- Which type(s) is/are appropriate for:
 - First/Last Name?
 - Phone Number?
 - Address?

One Possible Representation

- Use **parallel arrays**
 - Each array holds one kind of item
 - Index $N=10$ refers to all information for entry #N

Problem

- Poor separation of concerns
- We have to pass around everything related to one person, which is not practical
- Passing three arrays to a method ..



Another Solution:

The Object Oriented Paradigm (OOP)

What is OOP?

- ❖ *OOP: is a software design method that models the characteristics of real or abstract objects using software classes and objects.*
- ❖ What is an object? an object is a software bundle of related fields (variables) and methods. In OOP, a program is a collection of objects that act on one another (vs. procedures).

Characteristics of objects:

- State (what the objects have)
- Behavior (what the objects do)
- Identity (what makes them unique)



Software methodologies of Design at glance

- ❖ A paradigm is a way of thinking
- ❖ A Software paradigm is a way of thinking to design a software

- ❖ Ways of thinking of solving problems
 - Structured Design/Programming (a.k.a. procedural programming)

“Think in terms of steps and in terms of functions (methods and their composition)”

- Object-Oriented Design/Programming

“Think in terms of objects that do things”

What is the difference between a class and an object?

- ❖ A class is a template or blueprint for how to build an object.
- ❖ A class is a prototype that defines state placeholders and behavior common to all objects of its kind.
- ❖ Each object is a member of a single class — there is no multiple inheritance in Java.
- ❖ An object is an instance of a particular class.
- ❖ There are typically many object instances for any one given class (or type).
- ❖ Each object of a given class has the same built-in behavior but possibly a different state (data).
- ❖ Objects are instantiated (created).
- ❖ Object-oriented programs use objects.
- ❖ An object is a thing, both tangible and intangible. Account, Vehicle, Employee, etc.
- ❖ To create an object inside the computer program, we must provide a definition for objects—how they behave and what kinds of information they maintain —called a class.
- ❖ An object is called an instance of a class.

Major benefits of OOP

- ❖ Modularity — Separating entities into separate logical units makes them easier to code, understand, analyze, test, and maintain.
- ❖ Data hiding (encapsulation) — The implementation of an object's private data and actions can change without affecting other objects that depend on it.
- ❖ Code reuse through:
 - Composition — Objects can contain other objects
 - Inheritance — Objects can inherit state and behavior of other objects
- ❖ Easier design due to natural modeling:
 - OOP makes it easier to solve real-world problems by modeling natural objects in software objects.
 - The OO thought process is more intuitive than procedural, especially for tackling complex problems.

In Class Practice Six:

Designing a Phone Book Using the Object Oriented Programming



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