# 파이썬으로 배우는 데이터 구조

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## 학습 목표

객체지향 프로그래밍(OOP)의 개념을 이해한다

# Data Structures in Python Chapter 1 - 2

- **Object-Oriented Programming**
- OOP in Python
- OOP - Fraction Example
- OOP - Classes
- OOP - In-Place Operators
- Exceptions
- Exception Clauses

내 아들들을 먼 곳에서 이끌며 내 딸들을 땅 끝에서 오게 하며 내 이름으로 불려지는 모든 자 곧 내가 내 영광을 위하여 창조한 자를 오게 하라 그를 내가 지었고 그를 내가 만들었노라 (사43:6-7)

그런즉 너희가 먹든지 마시든지 무엇을 하든지 다 하나님의 영광을 위하여 하라 (고전10:31)

## Agenda

- **Object-Oriented Programming**
  - **Objects - State and Behavior**
  - **Classes**
- OOP in Python
  - Constructors
  - Methods & Self
  - Point class
  - Saving a class file and the module Geometry.py
  - Data Field Encapsulation

- References:
  - Problem Solving with Algorithms and Data Structures using Python
    - Chapter 1.13 Object-Oriented Programming in Python

## Exercise

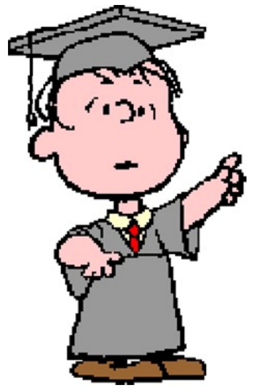
- What is the output of the following code fragment?

```
x = ['a', 'b', 'c']
y = x
z = ['a', 'b', 'c']
print (x == y)
print (x is y)
print (x == z)
print (x is z)
```

```
x = 'Hello'
y = x
z = 'Hello'
print (x == y)
print (x is y)
print (x == z)
print (x is z)
```

## Object Oriented Programming(OOP)

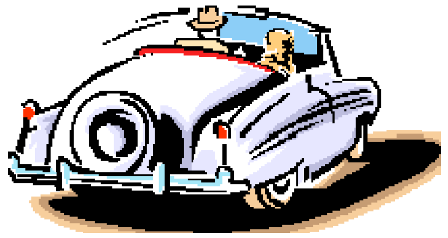
- An **object** represents an entity in the real world that can be distinctly identified, e.g., students, dogs, cars, cats, books.



- Object Oriented Programming(OOP) involves the use of objects to create programs.

## Objects

- Cars may have:
  - **information:** color, current speed, current gear, etc.
  - **function:** accelerate, brake, change gear, reverse, etc.



Car A

color: red
speed: 50
doors: 2
gear: 4th

Car B

color: white
**speed: 5**
doors: 4
gear: 1st

accelerate →

color: white
**speed: 10**
doors: 4
gear: 1st

## Object State and Behavior

- Every real world object has:
  - State — information that the object stores.
  - Behavior — functionality of the object, i.e., what the object  can do.

- Example:
  - Consider a system managing university students.
  - A student object has:
    - State — id, name, age, contact number, address, stage, grade, completed courses, current courses, advisor, faculty, …
    - Behavior — enroll in a new course, change contact number,  change enrollment, choose degree, …
  - A person object has:
    - State - id, name, age, contact number, address, …
    - Behavior - eat, drink, wear, talk, work, meet, swim, run, drive, …

## Object is state + behavior

- A software object's state is represented by its variables, called **data fields.**
- A software object implements its behavior with **methods.**
  - Every object is a bundle of variables and related methods.
  - We make an object perform actions by invoking the methods on that object.

- Example:

```
    my_list = [ 1, 2, 3 ]
    my_list.reverse()
```

## In a Program

- Our program consists of many different objects.
- **Two objects of the same kind would have the same set of behaviors, but independent state information.**
  - Two string objects store different words, but can perform same methods, e.g., lower(), split(), index(), etc.

- For an object in our program
  - State — is defined by variables (data fields).
  - Behaviors — is defined by methods (actions).

- The definition of a particular kind of objects is called a **class**. Once created, an object is **an instance of a class**.

## Python Class

- A **class** is the structure we use to define a category of objects.
  It defines the **state and behavior** of a category of objects.
- A class **is a template or blueprint defining t**he date fields and actions (methods) that any instance (object) of that class can have.
- For an object in our program
  - State — is defined by variables (data fields).
  - Behaviors — is defined  by methods  (actions).
- Analogies for class and object:
  - Factory mold and products produced from that mold
  - Blueprint and apartment building units
  - Cookie cutter and cookies

## Classes

- Python has a number of built-in classes
    - list, dict, set, int, float, boolean, str
- We can define our own classes
    - creates a new type of object in Python

```
class name_of_the_class:
    # definition of the class goes here
    # initializer
    # methods
```

- Classes consist of:
    - **state** variables (sometimes called instance variables)
    - **methods** (functions that are linked to a particular instance of the class)

## Example

- An example:

```
class foo:
     a, b, c = 0, "ace", (1,2)
```

multiple assignments

- Instantiating Classes
  - A class is instantiated by calling the class object:

```
obj = foo()
print(obj.a)
print(obj.b)
print(obj.c)
```

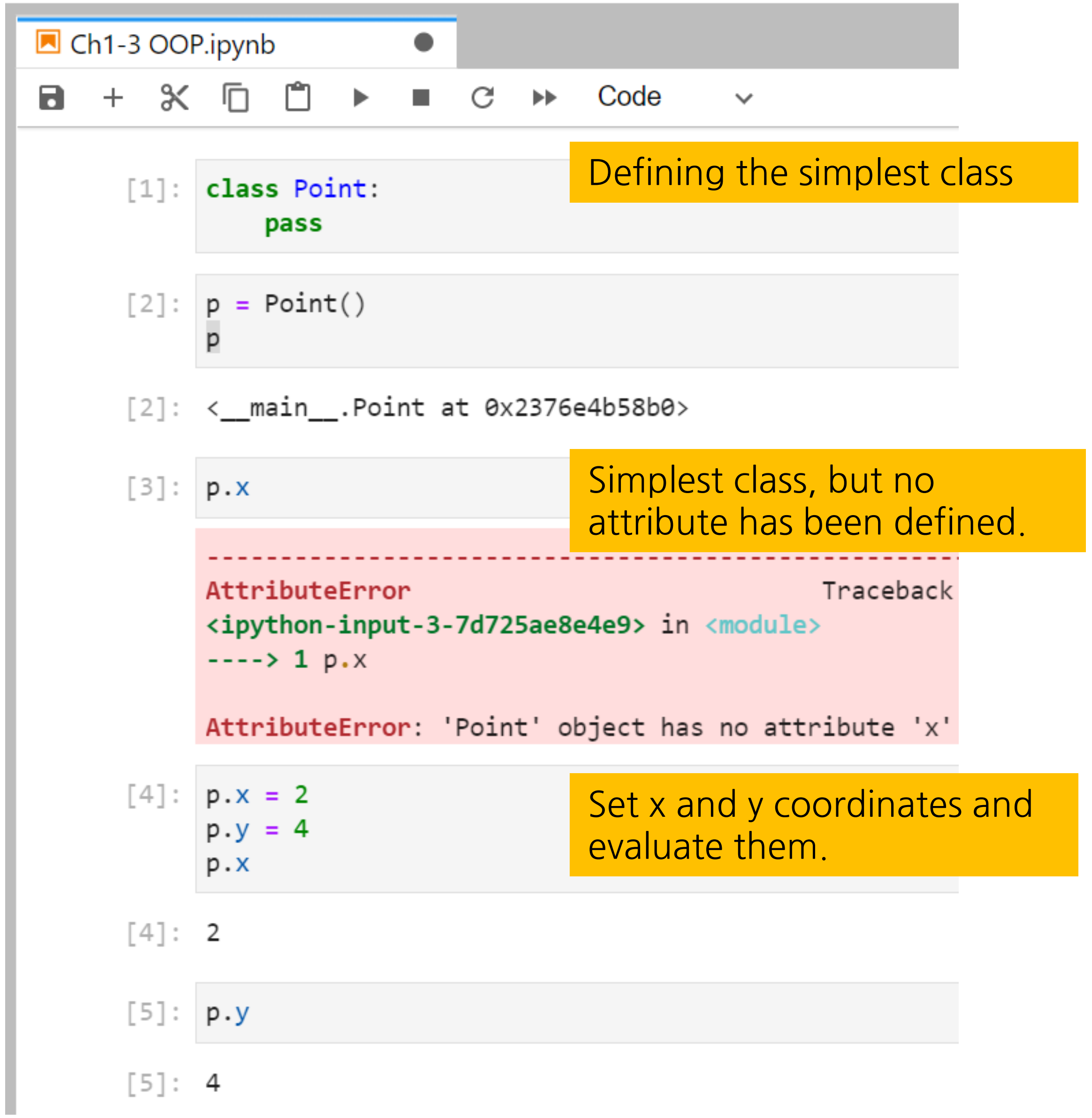
```
0
ace
(1,2)
```

## The simplest class possible

- A simple example:

```
class Point:
    pass
```

  - “pass” is a statement that does nothing. It is often used as a placeholder when developing code



```
[1]: class Point:
         pass
```

Defining the simplest class

```
[2]: p = Point()
     p

[2]: <__main__.Point at 0x2376e4b58b0>

[3]: p.x

---------------------------------------------------------------------------
AttributeError                            Traceback
<ipython-input-3-7d725ae8e4e9> in <module>
----> 1 p.x

AttributeError: 'Point' object has no attribute 'x'
```

Simplest class, but no attribute has been defined.

```
[4]: p.x = 2
     p.y = 4
     p.x

[4]: 2

[5]: p.y

[5]: 4
```

Set x and y coordinates and evaluate them.

## 학습 정리

1) 클래스(class)는 state(variables)와 behavior(methods)로 정의하고, 이를 사용하여 객체들을 생성한다

# 파이썬으로 배우는 데이터 구조

수고했습니다
곧 다음 시간에
다시 뵙겠습니
다