Object Oriented Design and Programming

Prepared by:

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Lecturer/Tutor at HCK

Agenda

- Module Leader and Lecturer/Tutor Introduction
- Module Introduction
- Week 1 lecture Coverage
  - ❑ Objects
  - ❑ SDLC
  - ❑ Object Oriented Analysis and Design
  - ❑ Object Oriented Design Concept vs Object Oriented Analysis Concept
  - ❑ Introduction to Python
  - ❑ OOP Concepts

Module Leaders

- **Er. Raj Prasad Shrestha** (B.E Computer Engineering, TU)
- **Lecturer and Tutor at Herald College Kathmandu**
- **Past Experiences:**
  - Assistant Lecturer and Project Coordinator at Aryan School of Engineering,Kathmandu
  - NodeJS Backend Developer at BitsBeat IT solution, Nepal
- **Interested Areas**:
  - **Blockchain** in AI and FinTech
  - Backend web development using **Python Django, NodeJS , Java Spring.**
- **Email**: raj.shrestha@heraldcollege.edu.np

- **Mr. Rupak Koirala** (MSc.IT ,LondonMet)
- **Lecturer and Tutor at Herald College Kathmandu since November 2016**
- **Interested Areas**:
  - **Machine Learning**
  - Game development using Unity
  - **Data Analytics**
- **Email**: rupak.koirala@heraldcollege.edu.np

Lecturer/Tutor

- **Er. Sachin Kafle**(B.E Computer Engineering, TU)
- **Lecturer and Tutor at Herald College Kathmandu**
- **Work History:**
  - Bitfourstack Technologies, New Baneshwor, **Co-Fouder**
  - Cyber Security Awareness Mission in Nepal (NGO), Chabahil , **Founder**
  - UDEMY: PROGRAMMING INSTRUCTOR, **Premium instructor**
  - Infinity labs, **Historical sites information systems**
- **Interested Areas**:
  - Internet of Things
  - Deep learning
  - Computer vision OPENCV, GANS
- **Email**: sachinkafle365@gmail.com

Module Introduction

- Overview of Module
  - ✓ What can you expect?
- Learning Objectives
  - ✓ How will you benefit?
- Learning Strategy
  - ✓ How you will learn?
- Assessment Overview
  - ✓ How you will be tested?

Overview of Module

- This module aims to think ,analyse and design real world problems in terms of modelled Objects (Object Oriented Design and Analysis) using UML diagrams.
- With the help of modelled UML diagrams students will develop a web based application using Python Django Web Framework.

Learning Objectives

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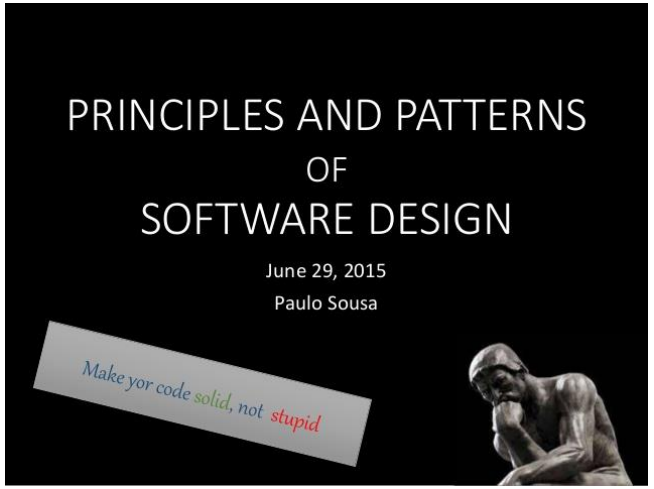
Object Oriented Analysis and Design

UNIFIED MODELING LANGUAGE™

python™ django

Server side Programming using Python Django

Software Design Patterns and Principles



Learning Strategy

- Taught over 1 semester
- Total 10 weeks of class
- Each week consists of 1 Lecture (1.5 Hours) , 1 Workshop(2 Hours) and 1 tutorial class (1 hour)
  - Lecture: **OO analysis, design and programming concepts**.
  - Tutorial : Revise Lecture and Discussion followed by demo
  - Workshop: Case Study , Exercises

Learning Strategy

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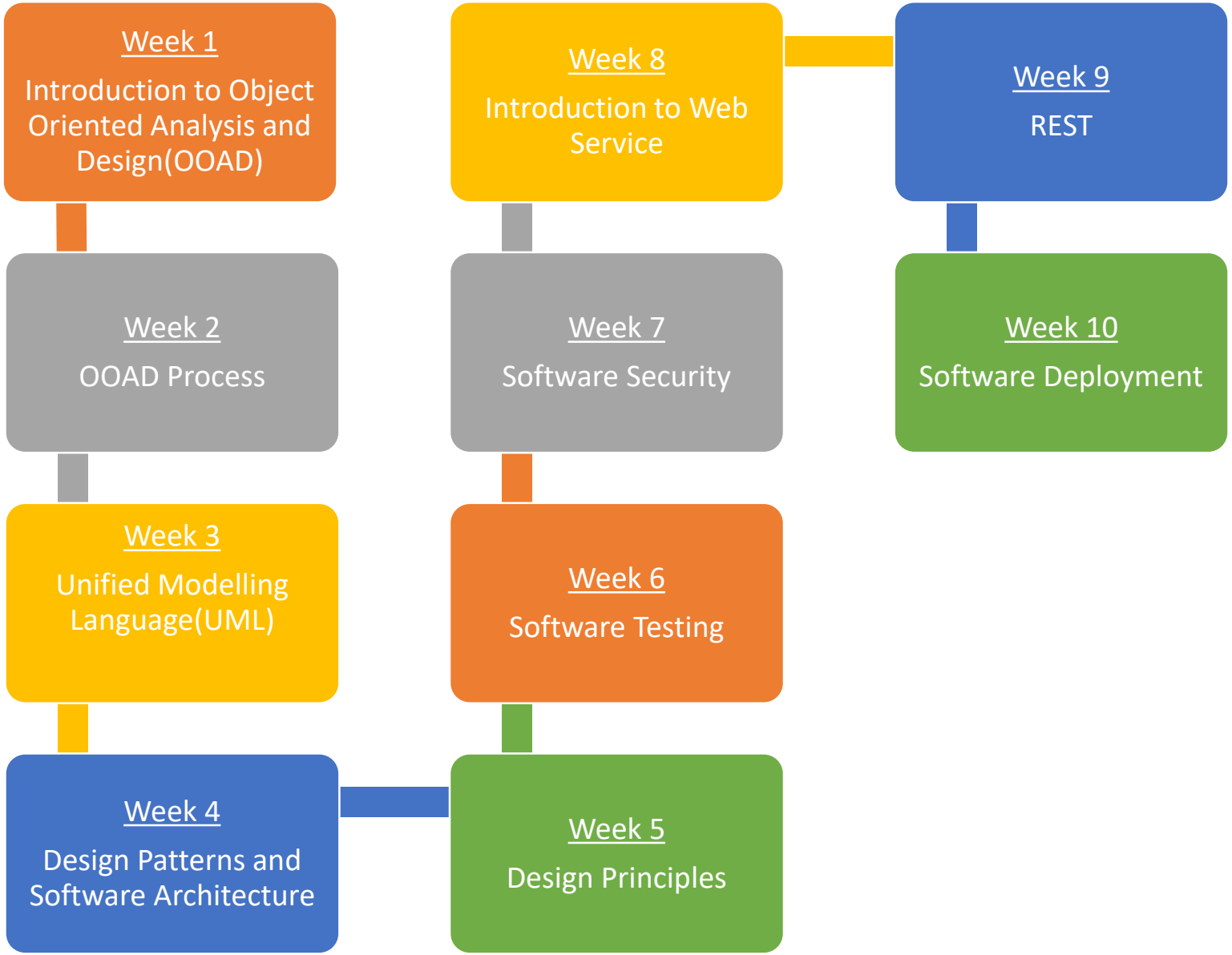
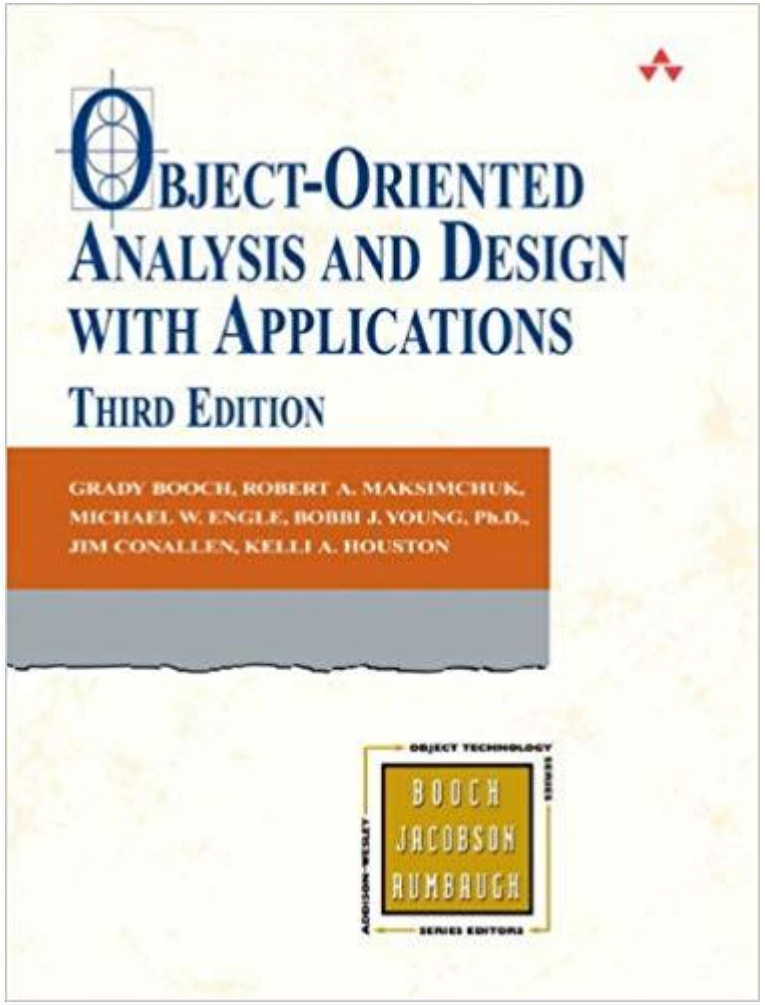
Attendance for all classes is important!

- Design and Programming cannot be learnt by memorizing. It is learnt through **constant practice**.
- We want to provide you the environment to practice and improve effectively.

Module Syllabus



Text Books


OBJECT-ORIENTED ANALYSIS AND DESIGN WITH APPLICATIONS
THIRD EDITION
GRADY BOOCH, ROBERT A. MAKSIMCHUK, MICHAEL W. ENGLE, BOBBI J. YOUNG, Ph.D., JIM CONALLEN, KELLI A. HOUSTON
OBJECT TECHNOLOGY SERIES
BOOCH
JACOBSON
RUMBAUGH
SERIES EDITORS


UPDATED for Django 2.2
Build a website with Django 2
Go from zero knowledge to your own website using the easiest to learn programming language on the Internet
Nigel George

Assessment Details

- Two Assessments:

  1. Individual Written test = 40 % [Syllabus: All Week Chapters Except Python and Django Coding Part]

  2. Group Continuous Assessment = 60 % [According to the coursework]

Assessment Details

Week	Assessments
Week – 3	Start of Continuous Assessment – I
Week – 6	Continuous Assessment - II
Week – 8	Continuous Assessment – III
Week – 11	Written Test
Week -12	Final Submission of the Coursework

Assessment Details

- **Module Grading Standards in the UK**

Range of Marks	Grade	Remarks
70 - 100	**A**	Excellent: outstanding performance with only minor errors
60 – 69	**B**	Very Good: above the average standard but with some errors
50 – 59	**C**	Good: generally sound work with a number of notable errors
43 - 49	**D**	Satisfactory: fair but with significant shortcomings
40 - 42	**E**	Sufficient: performance meets the minimum criteria
0 - 39	**F**	Fail: performance does not meet the minimum criteria and considerable further work is required

Motivation- Why Study?

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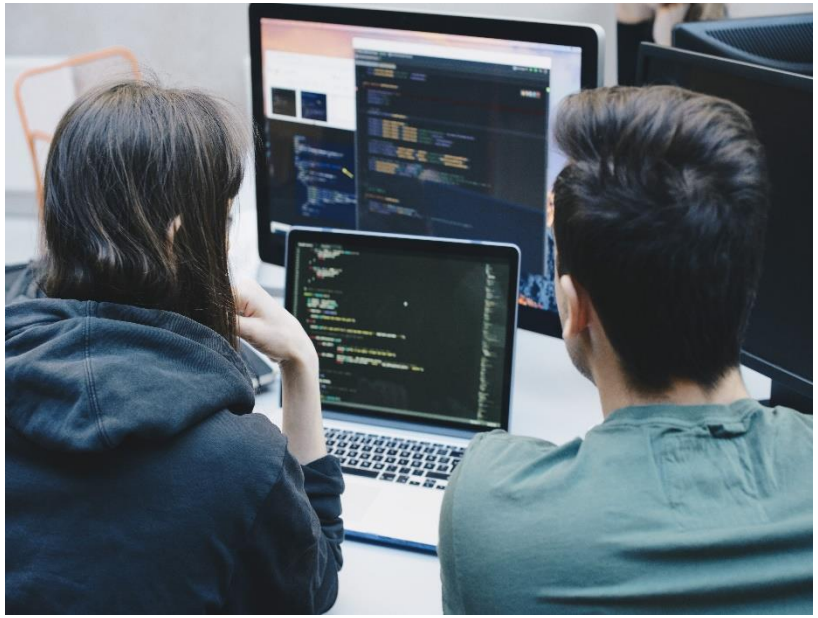
- To work in software industries, every Software Engineer **should** know
  - ✓**Object Oriented Analysis and Design**
  - ✓Data structure and algorithm
  - ✓**Software Development Process Models**
  - ✓**Design Principles**
  - ✓**Design Patterns**
  - ✓**Version control – Git**
  - ✓Other many

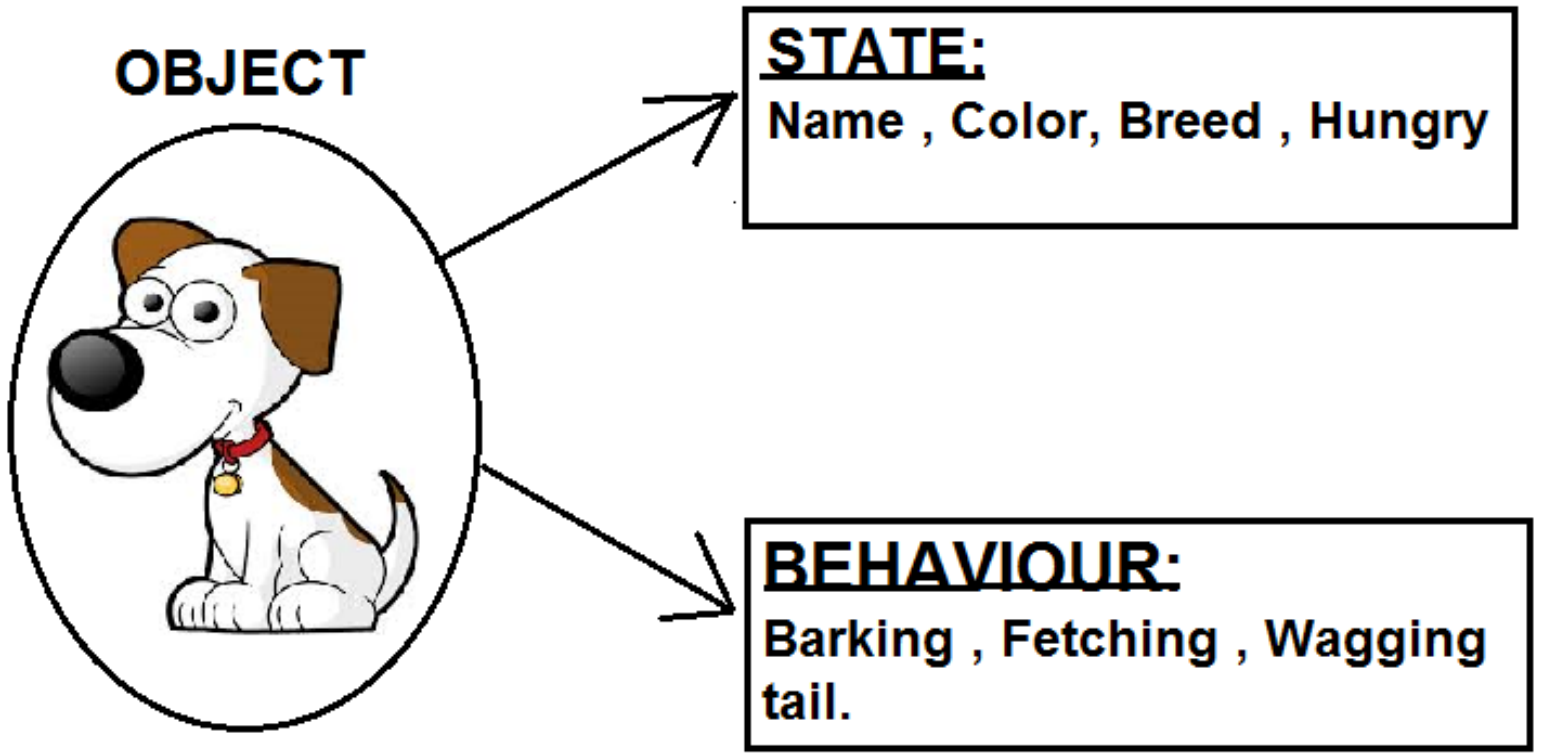


Let’s get started with Lecture 1

Objects

- Objects directly relate to **real-world 'entities'**.
- An object has identity, state & behaviour.
  - **Identity**: the property of an object that distinguishes it from other objects
  - **State**: describes the data stored in the object
  - **Behaviour**: describes the methods in the object's interface by which the object can be used
- The state of an object is one of the possible conditions in which an object may exist.
- The state of an object is represented by the **values of its properties (attributes).**

Example:


OBJECT
STATE:
Name , Color, Breed , Hungry
BEHAVIOUR:
Barking , Fetching , Wagging tail.

Advantages of using objects

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- Bundling code into individual software objects provides a number of benefits, including:

  - Modularity:
    - ✓ The source code for an object can be written and maintained independently of the source code for other objects.
  - Information-hiding:
    - ✓ By interacting only with an object's methods, the details of its internal implementation remain hidden from the outside world.
  - Code re-use:
    - ✓ If an object already exists, you can use that object in your program.
  - Pluggability and debugging ease:
    - ✓ If a particular object turns out to be problematic, you can simply remove it from your application and plug in a different object as its replacement.

Scenario

Object Oriented System

Super Potato is famous game parlour in Tokyo Japan. It has been providing various video games for video game lovers. Super Potato owns more than five hundred Game Station (Console) for its customer.

Through this coursework the students should be able to write a class to represent a **Super Potato Video Game Station**. The class will store game station booking date, Game Station description, hourly rate, time duration and availability status for booking. The class will be able to display the description of the Game Station and the booking details.

Write a class to represent a Super Potato Game Parlour. It will simulate adding a game station to the Company, removing a Game Station from the list of game station, book game station, make game station available, listing all Game Stations that are currently available and searching for a specific game station. Game Stations from the Game Parlour will be represented by objects of the class that was developed for the first part of the coursework.

- You developed this system using object-oriented language – Java.
- You all are aware of object oriented development.

Steps you took

Step : 1 Start with java programming as instructed in your coursework.

Step: 2 Apply some logic wherever necessary

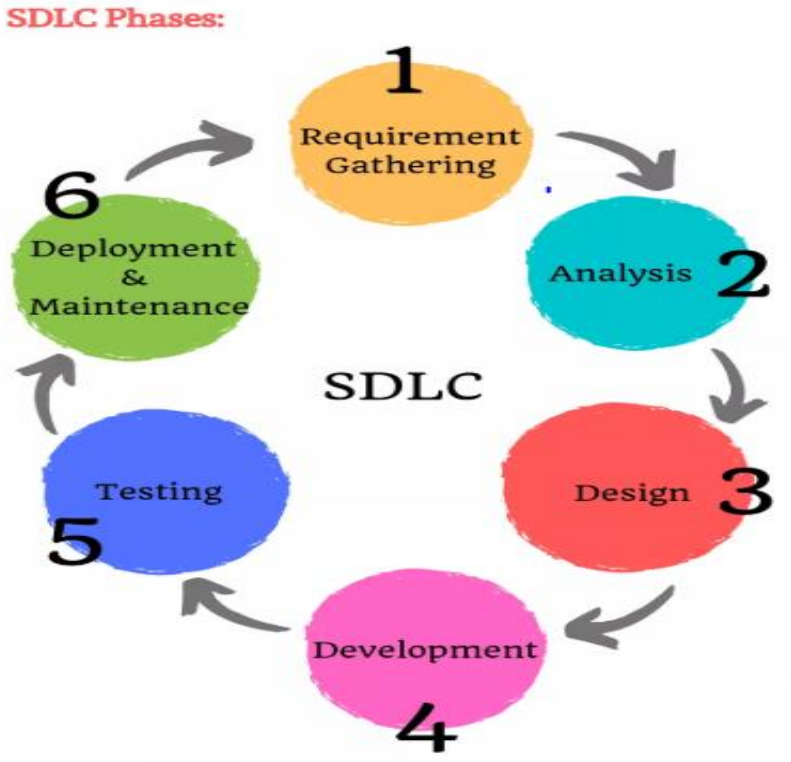
Step : 3 Run and Test the java code and deliver the coursework.

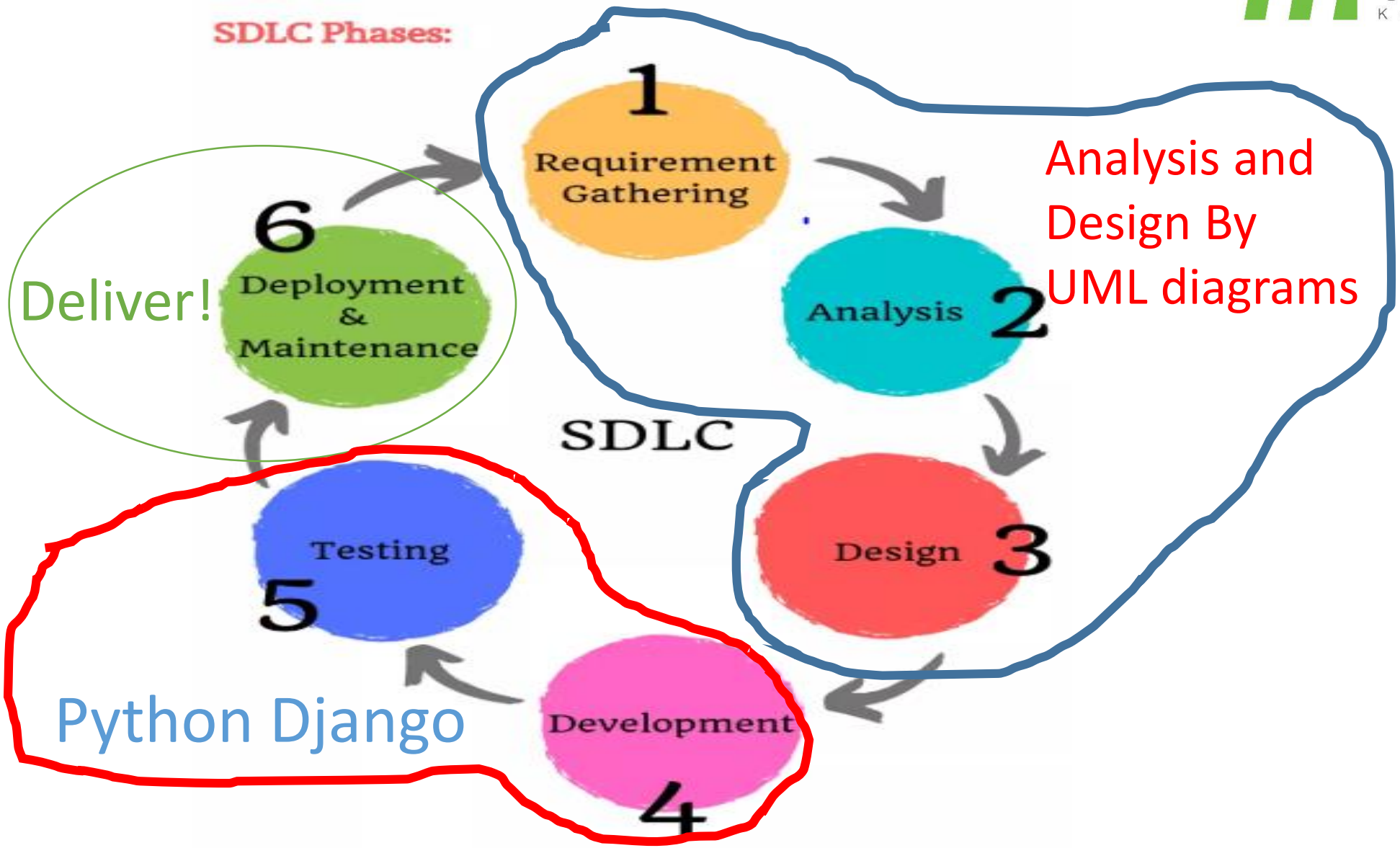
- Only with OOP programming, it is impossible to develop a **well designed object oriented system**. ***Extreme Rush To Code***
- Before we start with **Object Oriented programming(OOP)**, we need to do **Object Oriented Analysis(OOA)** and **Object Oriented Design(OOD)**.

How Object oriented system is developed in real world?

- Following the phases of Software Development Life Cycle (SDLC) , Object Oriented System is developed.
- SDLC is a process used to develop a **well designed** software product in a **systematic way** aiming to deliver a **high-quality** product.

1. Identify what system must do using UML diagrams (Usecases, Usecase diagram)
2. Identify real world objects required to model the system using UML diagrams (Class,Collaboration ,State and Sequence diagram)
3. Identify software objects that are required to model the system using various UML diagrams (Modified Class,Collaboration ,State and Sequence diagram)
4. Implement the system using OOP programming
5. Run and Test the system as many as it requires
6. Deliver the system (UML diagram – Deployment diagram)




SDLC Phases:
1
Requirement Gathering
Analysis and Design By UML diagrams
Analysis
2
Design
3
Development
4
Testing
5
Deployment & Maintenance
6
Deliver!
SDLC
Python Django

KEEP CALM AND HAVE A BREAK FOR 5 MINUTES

Object Oriented Analysis

- **Analysis e**mphasizes an investigation of the problem and requirements, rather than a solution.

"Analysis" is a broad term, best qualified, as in requirements analysis (an investigation of the requirements) or object-oriented analysis (an investigation of the domain objects)

- In the phase of OOA the typical question starts with What...? like “What will my program need to do?”, “What will the classes in my program be?” and “What will each class be responsible for?” .

- Hence, OOA cares about the real world and how to model this real world without getting into much detail.
- **Craig Larman** describes the OOA phase as an investigation of the problem and requirements, rather than finding a solution to the problem.

Object Oriented Design

- **Design** emphasizes a conceptual solution (in software and hardware) that fulfills the requirements, rather than its implementation.

- Ultimately, designs can be implemented, and the implementation (such as code) expresses the true and complete realized design.

- In the OOD phase, the question typically starts with How...? like "How will this class handle it's responsibilities?", "How to ensure that this class knows all the information it needs?" and "How will classes in the design communicate?" .

- The OOD phase deals with finding a conceptual solution to the problem – it is about fulfilling the requirements, but not about implementing the solution

What is Object-Oriented Analysis and Design?

- OOA: Aims at investigation of the problem
  - To identify real world objects(domain objects)
  - For eg: In Bank Management system real world objects are **Bank, Customer, Staffs etc**.
- OOD: Aims at how to solve the problem
    - To identify software objects to model the system.
    - For eg. **Bank** will be software object.
- OOP: Implementation: To implement the software objects in Java or PHP or **Python etc**.
  - For eg: **Bank** class in python.

OOA, OOD and OOP

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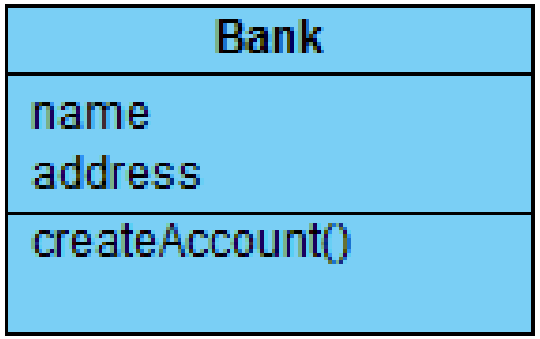
Analysis
Investigation of the Problem

Design
Logical solution to the problem

Implementation
Code

Bank



Bank class diagram

```python
class Bank:
    def set_data(self,name,address):
        self.name = name
        self.address = address

    def get_data(self):
        print("Name",self.name)
        print("Address",self.address)

    def create_account(self):
        #create account logic
```

Bank class implementation in Python

Introduction to Python

Python Features:

- Easy to learn and use
- Procedure oriented Programming
- Object Oriented Programming (OOP)
- Functional Programming
- Large standard library

By Guido van Rossum in 1989

Some Facts about Python:

- It can be used for web development, mobile app development, AI, Machine Learning, Big Data, Internet of Things, Block chain applications.
- Today's most popular language -TIOBE Index

Writing First Hello World Program in Python

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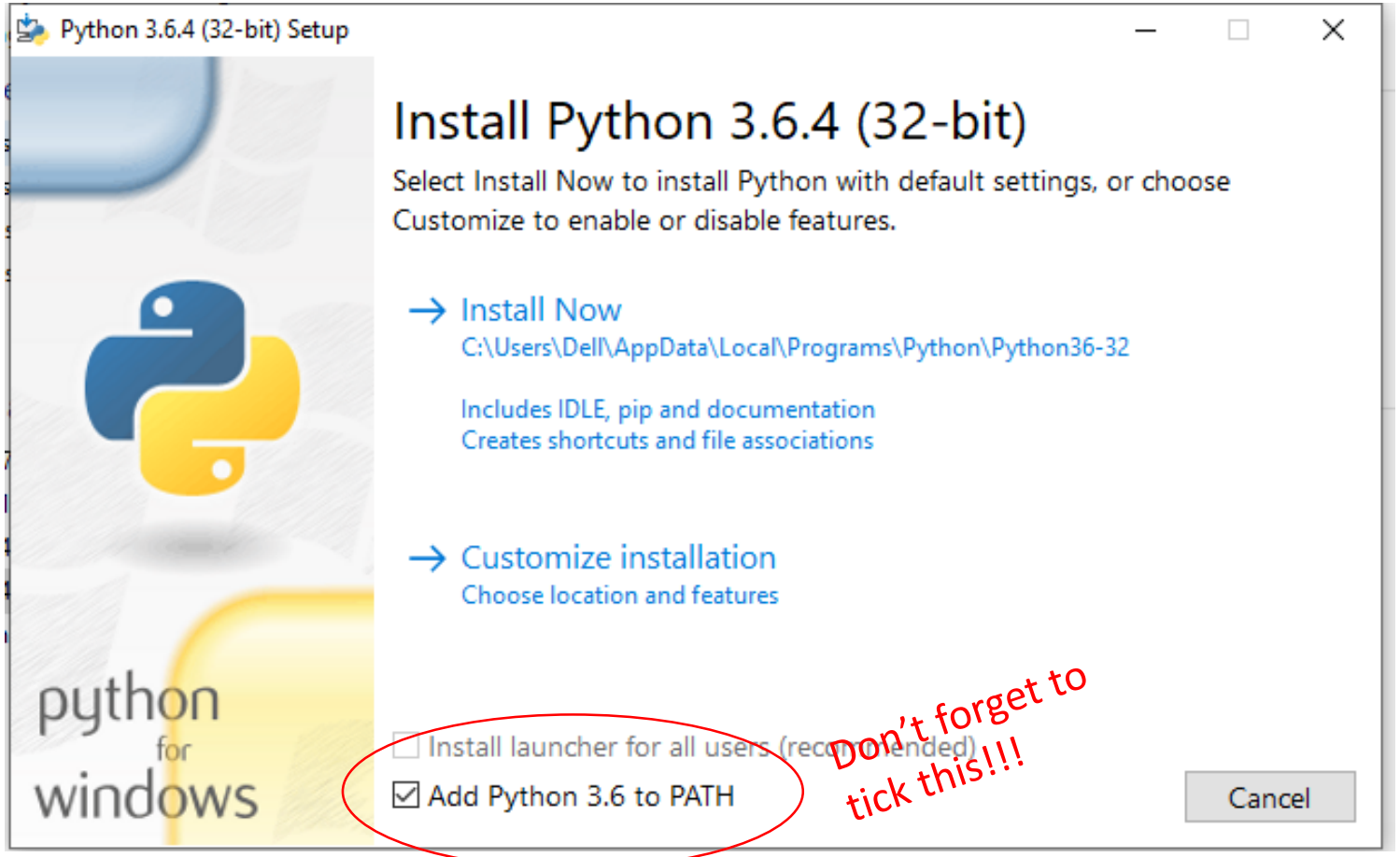
Steps:

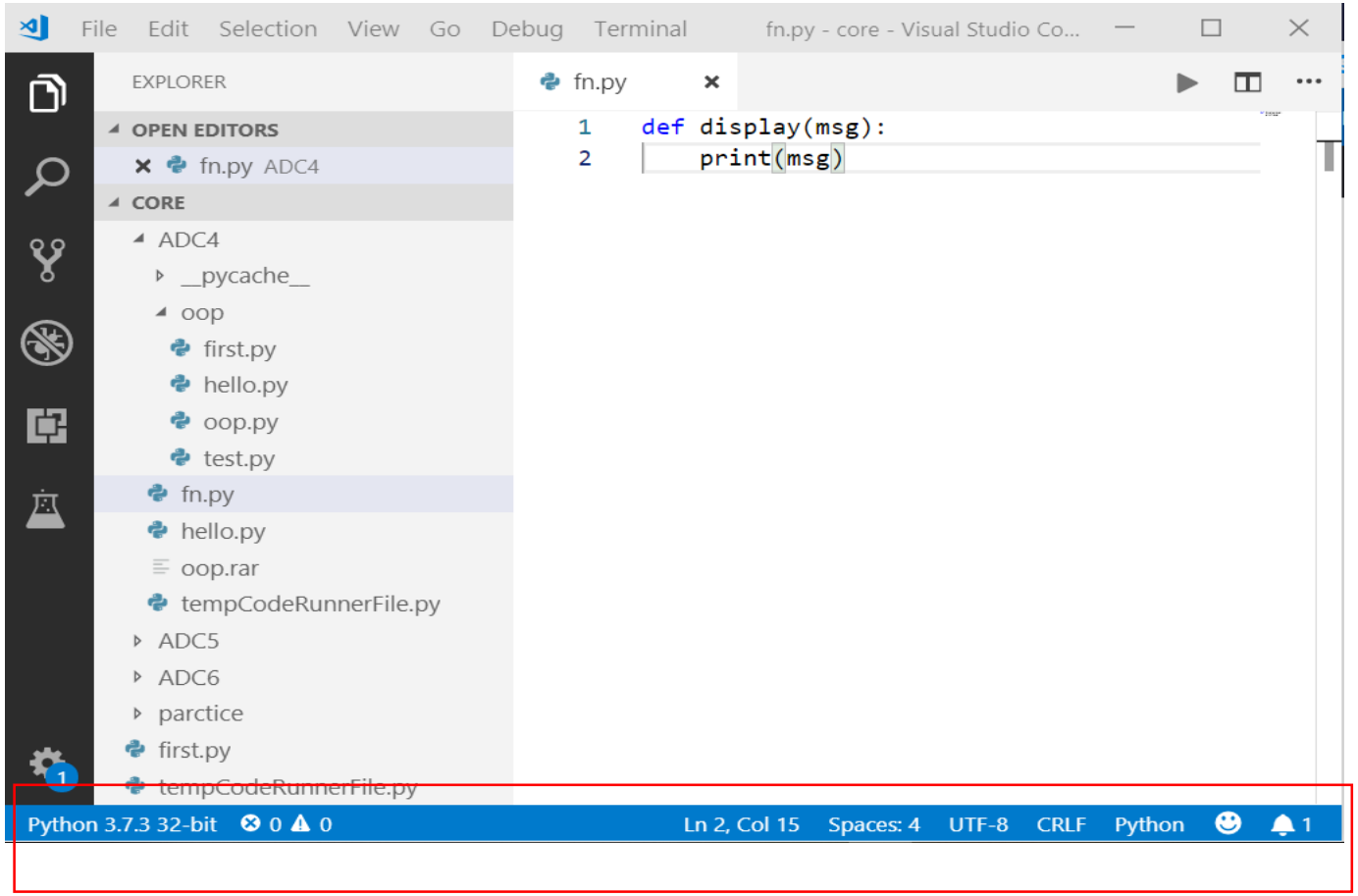
1. Download and Install Python in your computer from this website https://www.python.org/downloads/.



Writing First Hello World Program in Python

Step 2. Now install any editor you prefer for writing Python programs (Visual Studio Code or Pycharm)

For Visual Studio Code: https://code.visualstudio.com/Download



You Should see this in VSCode

Writing First Hello World Program in Python

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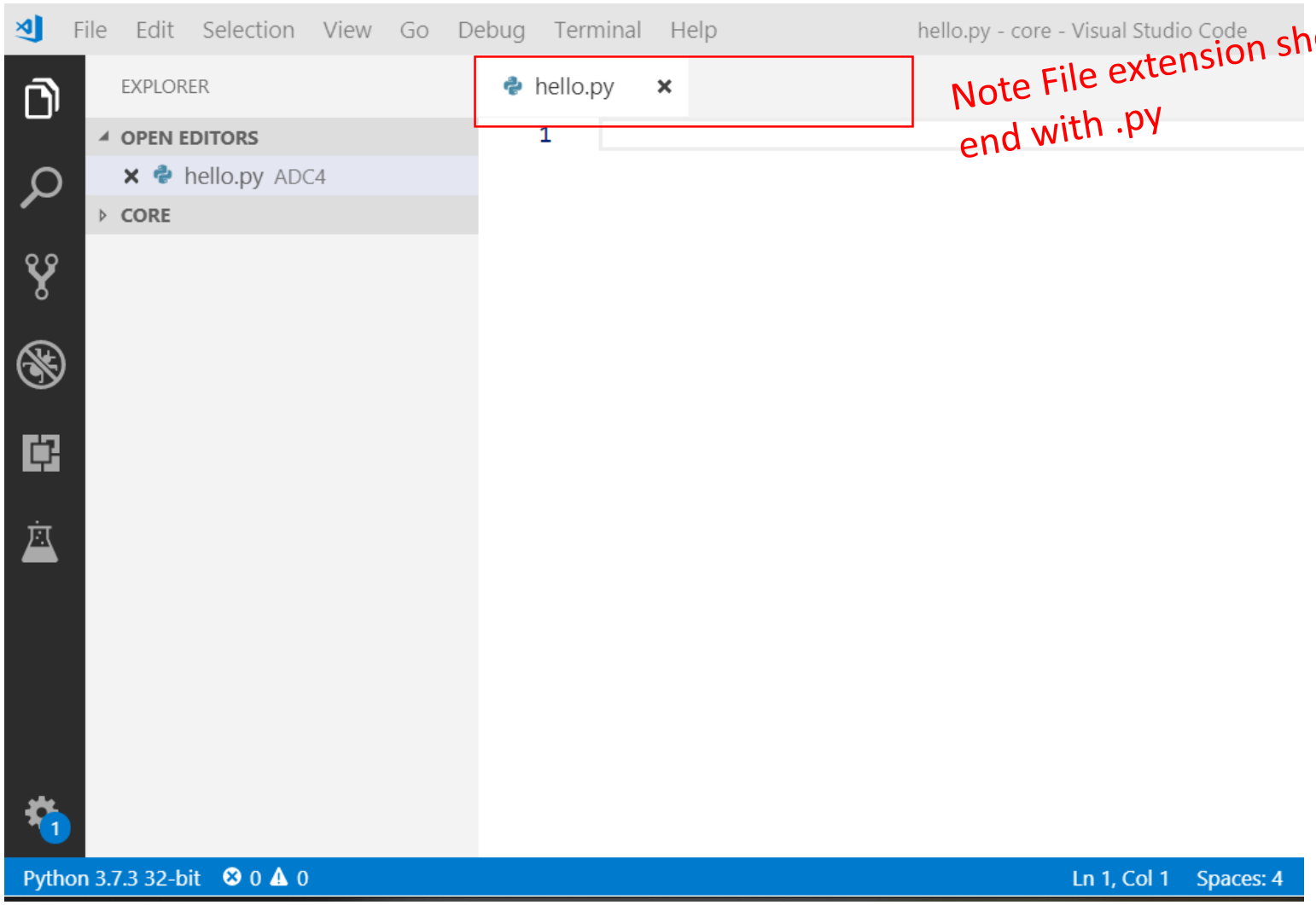
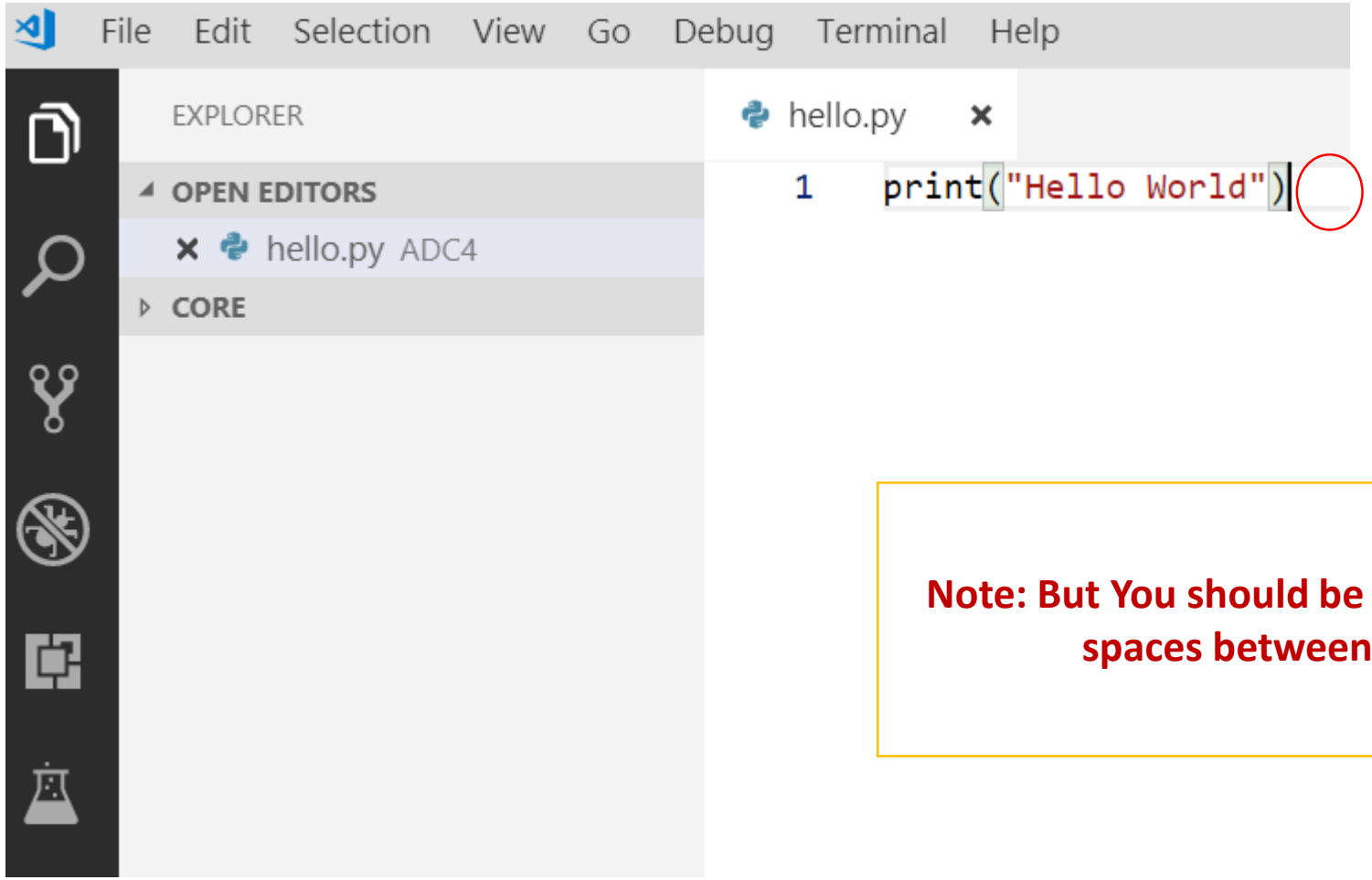
Step 3. Now Create a file by going to File menu and then select New File.



Writing First Hello World Program in Python

Step 3. Then paste this code print("Hello World") inside hello.py file.



In python, we don't need ;(semi colon) to end the statement ☺

Note: But You should be careful where you keep spaces between statements!!!!

Writing First Hello World Program in Python

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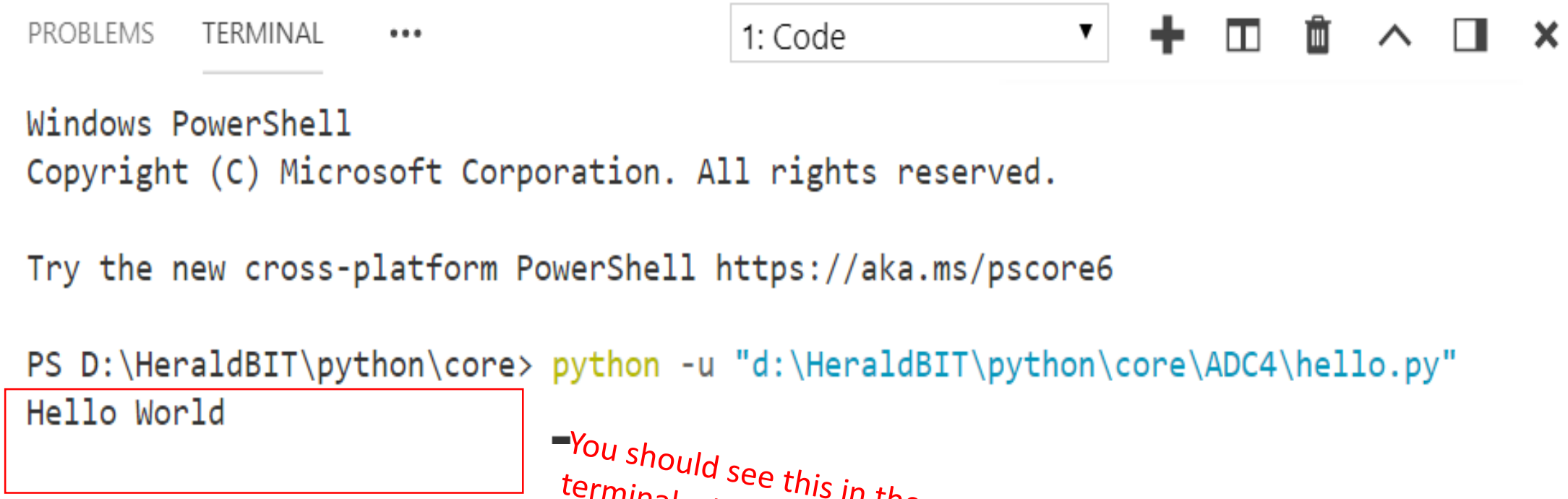
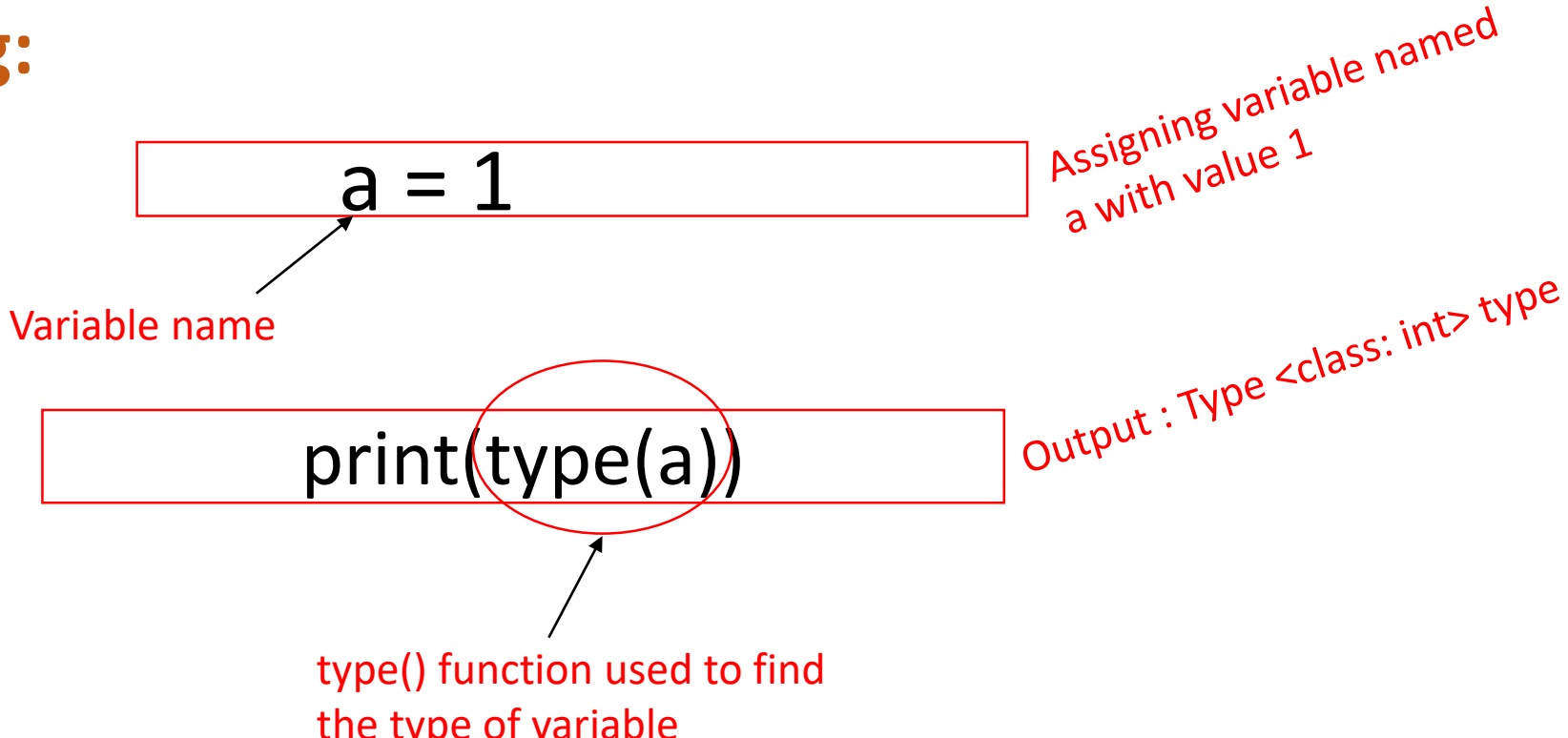
Step 4. Then execute this file.



- Python is an object oriented programming language.
- Almost everything in Python is an object, with its properties and methods.

Eg:



Python 3 Cheat Sheet

OOP Concepts

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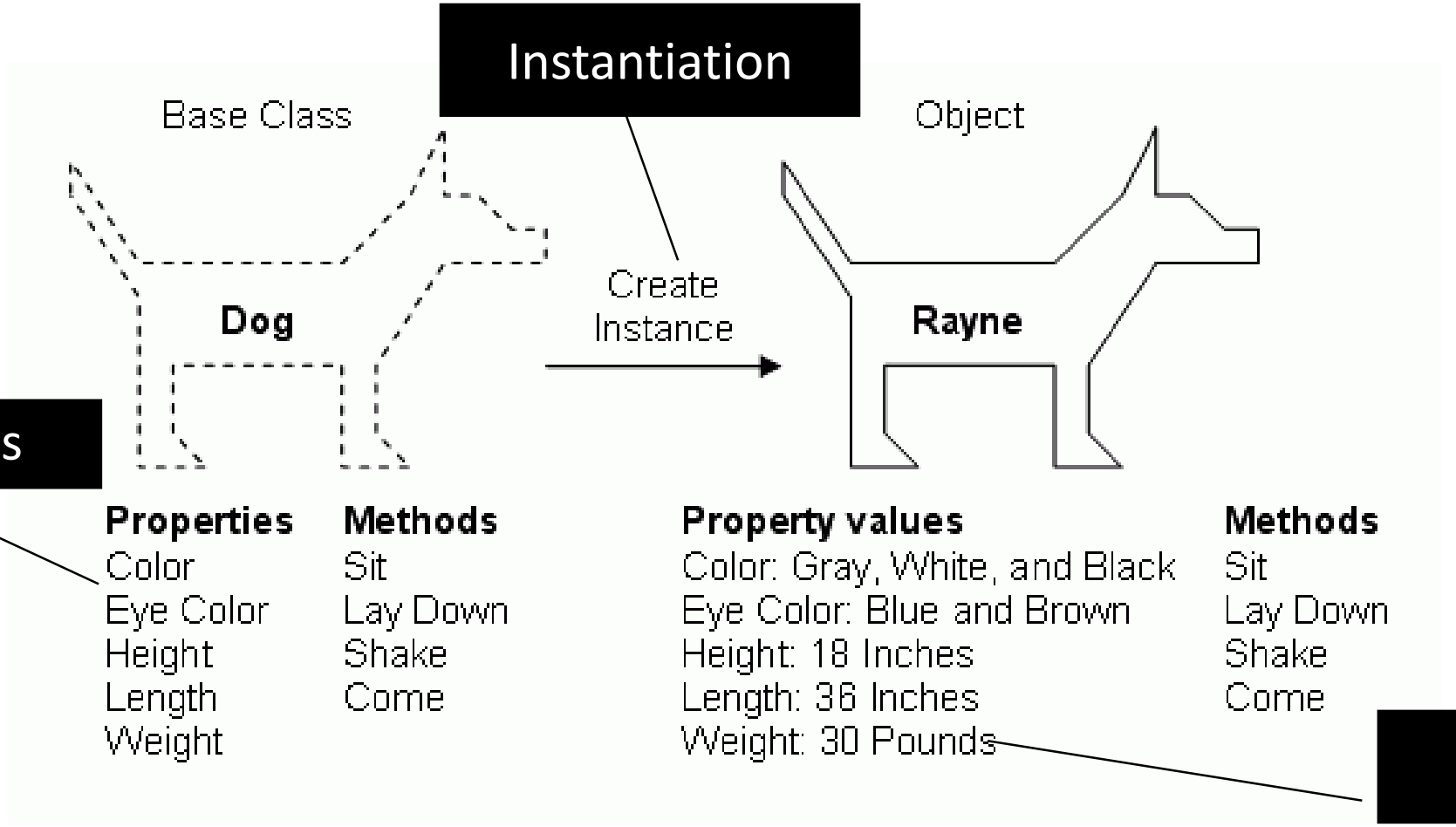
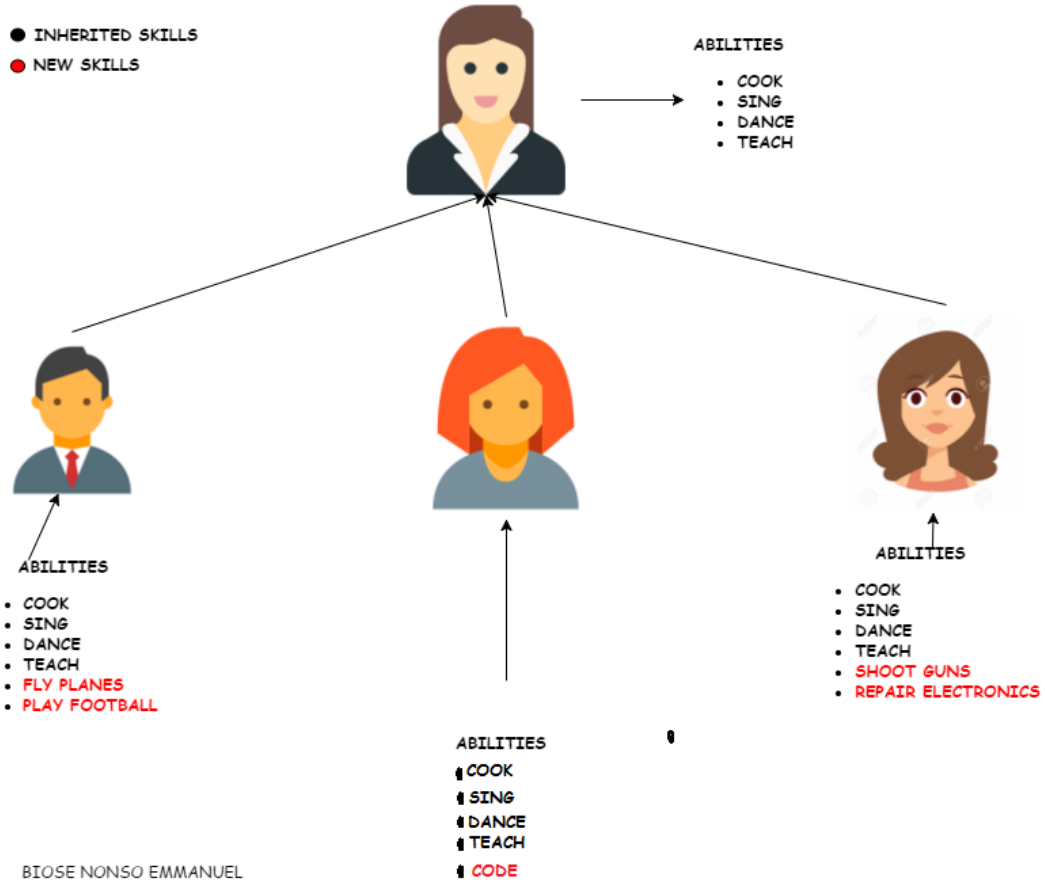
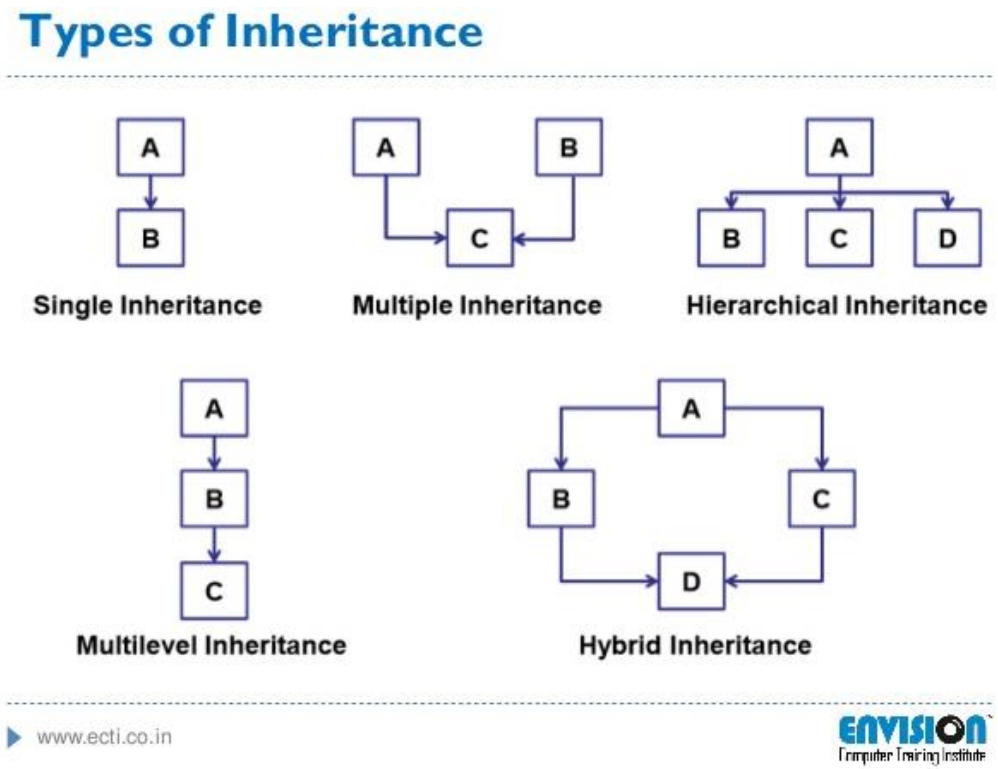
- It is necessary to understand some of the concepts used extensively in object-oriented programming. These include:
  - Objects
  - Classes
  - Data abstraction and encapsulation
  - Inheritance
  - Polymorphism
  - Dynamic binding
  - Message passing

CLASS VS OBJECT

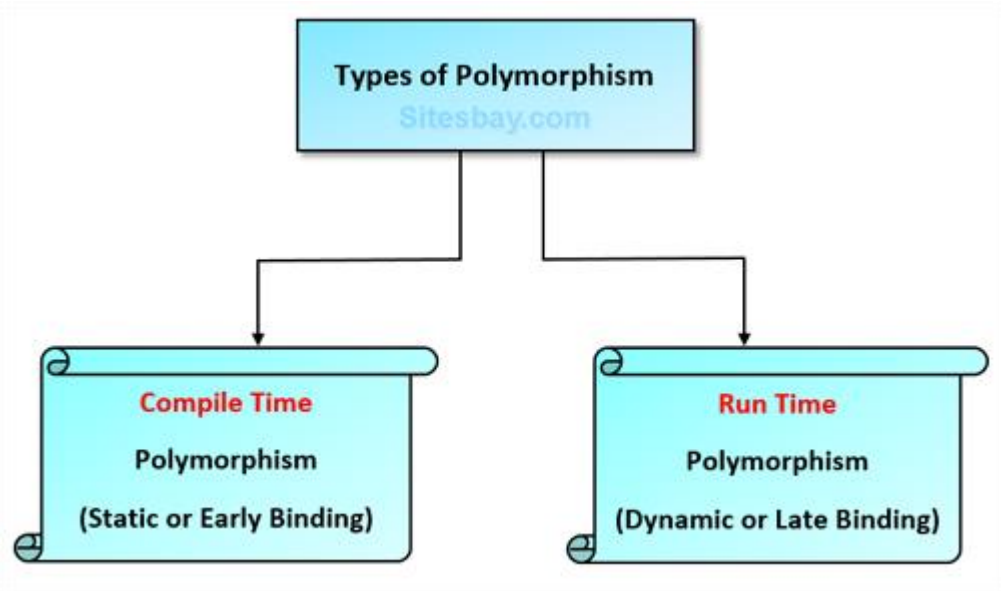


Inheritance

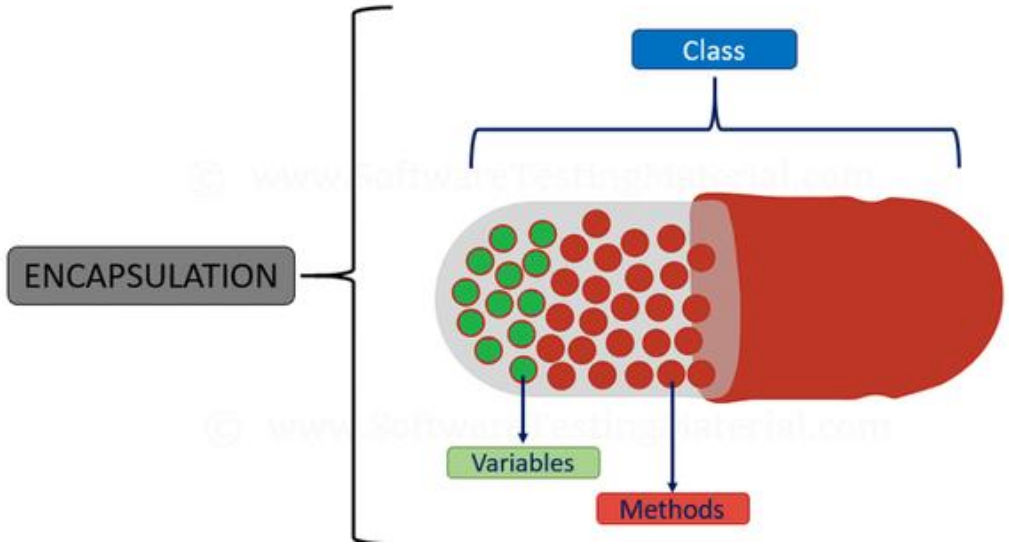


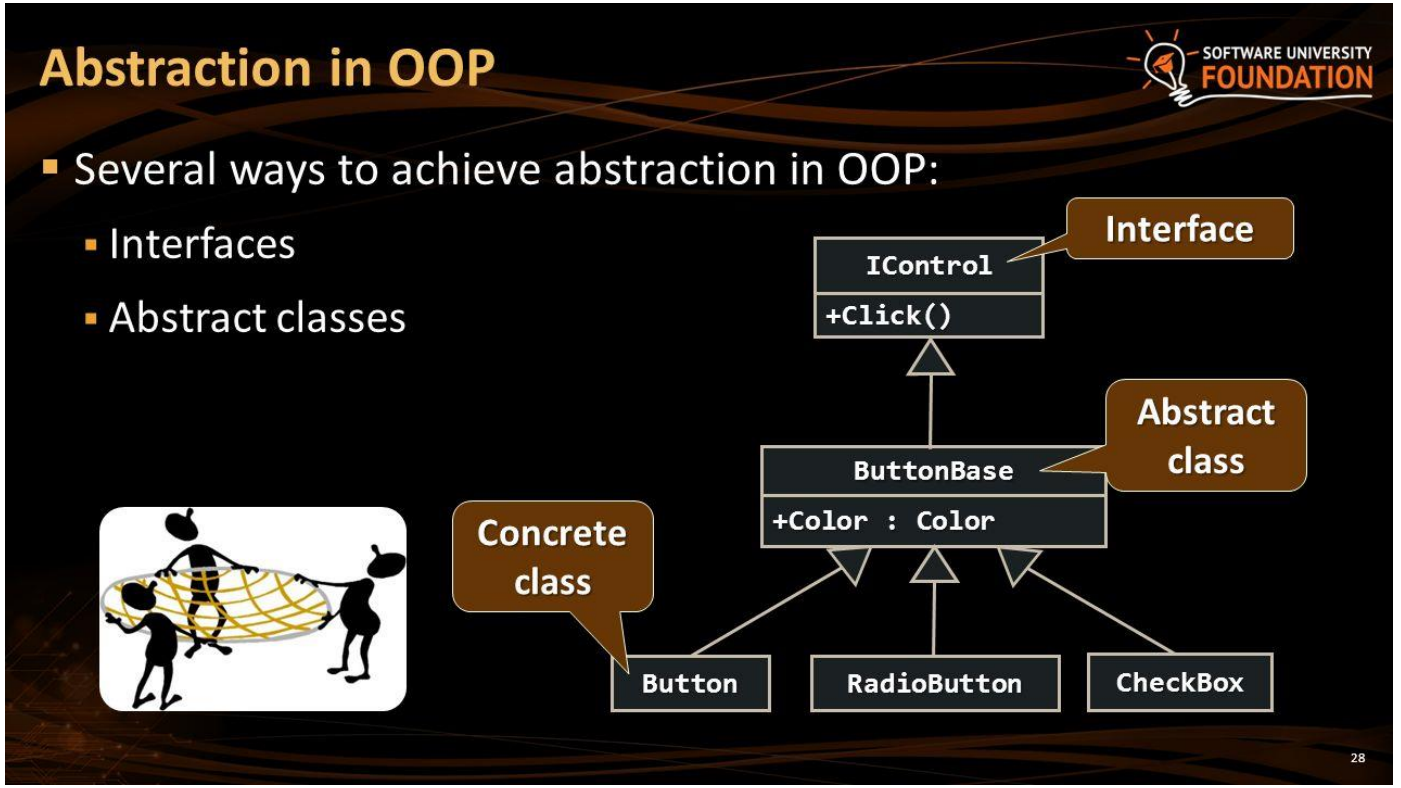


Polymorphism



Encapsulation and Abstraction





Summary

Topics Covered:

- Objects
- SDLC
- Object Oriented Analysis and Design
- Object Oriented Design Concept vs Object Oriented Analysis Concept
- Introduction to Python
- OOP Concepts

Any Questions?

References

1. https://personal.utdallas.edu/~chung/SP/applying-uml-and-patterns.pdf
2. https://airbrake.io/blog/design-patterns/object-oriented-analysis-and-design
3. https://www.geeksforgeeks.org/python-programming-language/