OBJECT ORIENTED PROGRAMMING

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Programming Paradigms- Procedural

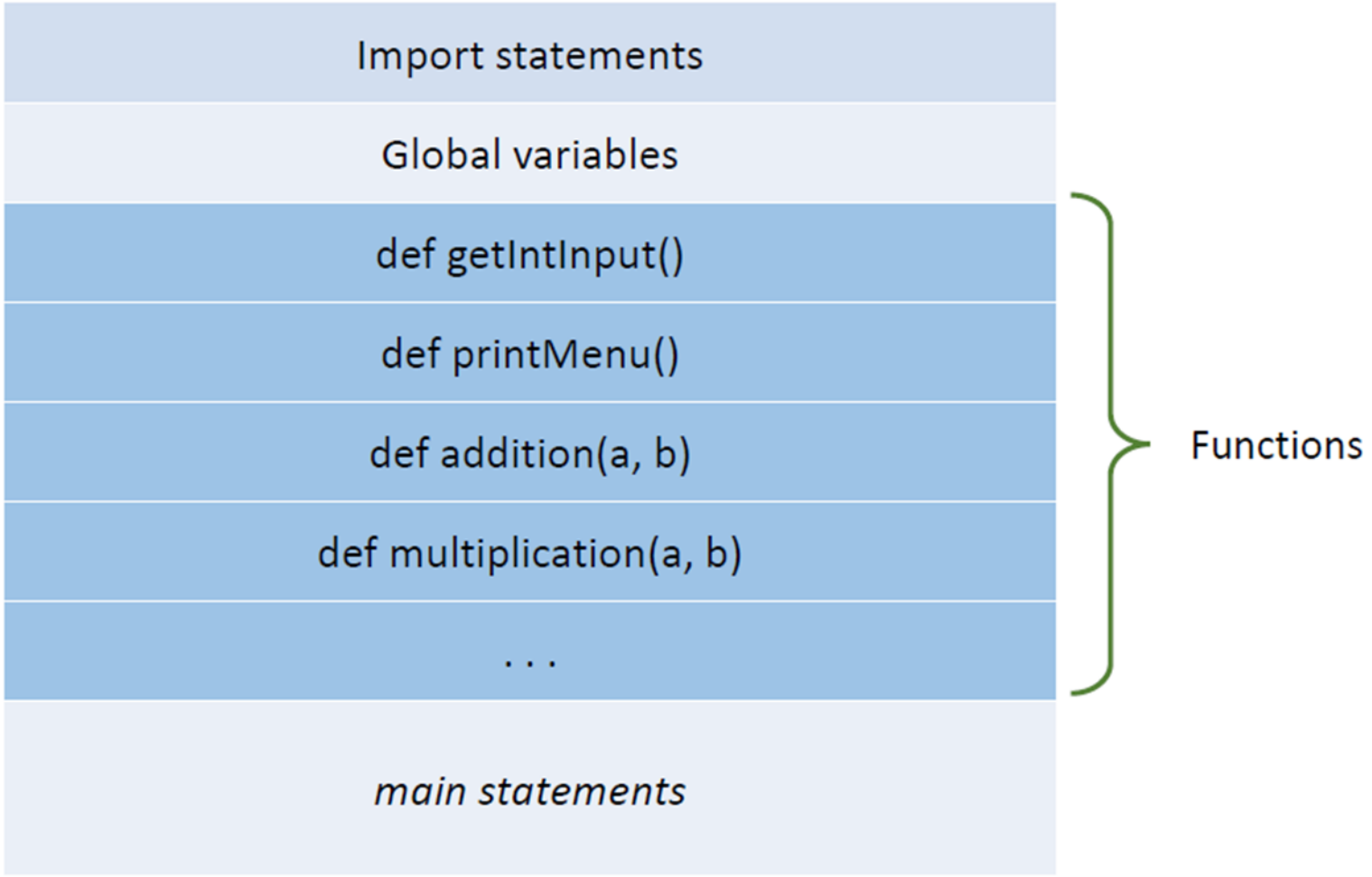
- Based on the concept of using procedures (functions)
  - Procedure is a sequence of commands to be executed
  - Any procedure can be called from any point within the general program, including other procedures or even itself
  - Data Variable Scope:
    - Global
    - Local
- Procedure & Program is divided into modules
- Every module has its own data and function which can be called by other modules.

Programming Paradigms- Procedural…

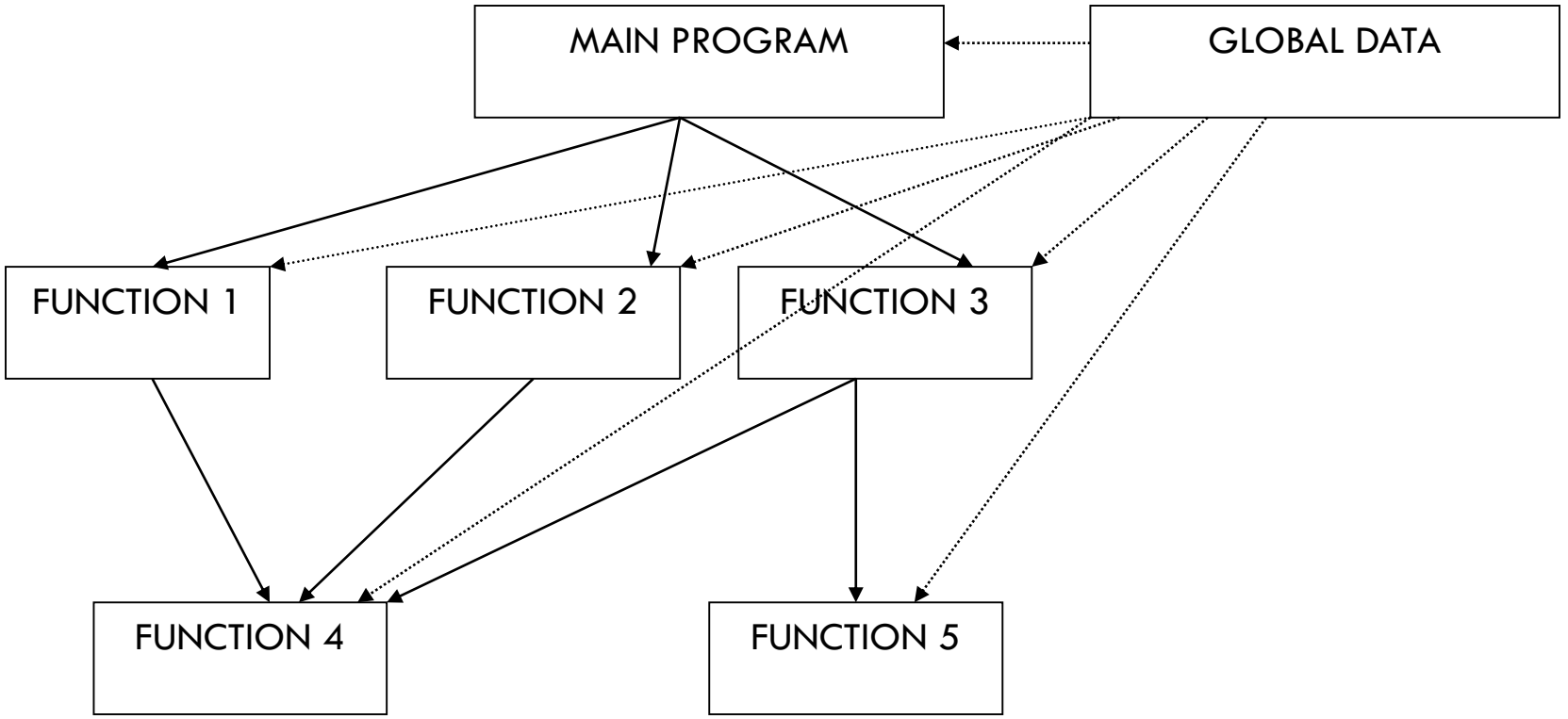
- Teaching-learning process
  - Students take admission in department of university
  - Faculties take lectures and labs and evaluate students
  - Students attend lectures and labs
  - Students participate in different events
  - Students attend workshops
  - At the end of semester, university conducts exam
  - Faculties set questions papers
  - Students appear for the examination under Faculties' supervision
  - Faculties evaluate answersheets
  - Faculties conduct practical evaluation
  - University generate the results (SPI and CPI of students)
  - University considers performance appraisal of faculties

Programming Paradigms- Procedural…

- Arithmetic Calculator



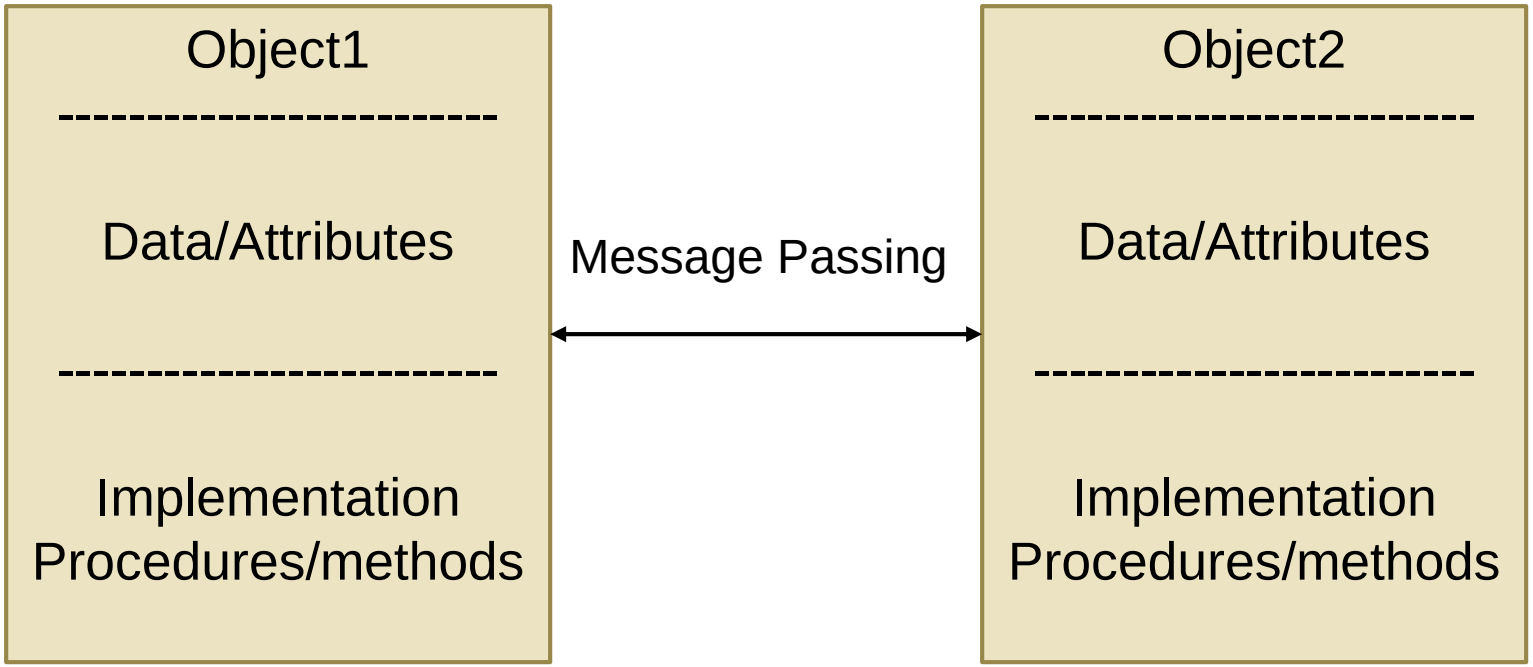
Programming Paradigms- Procedural…



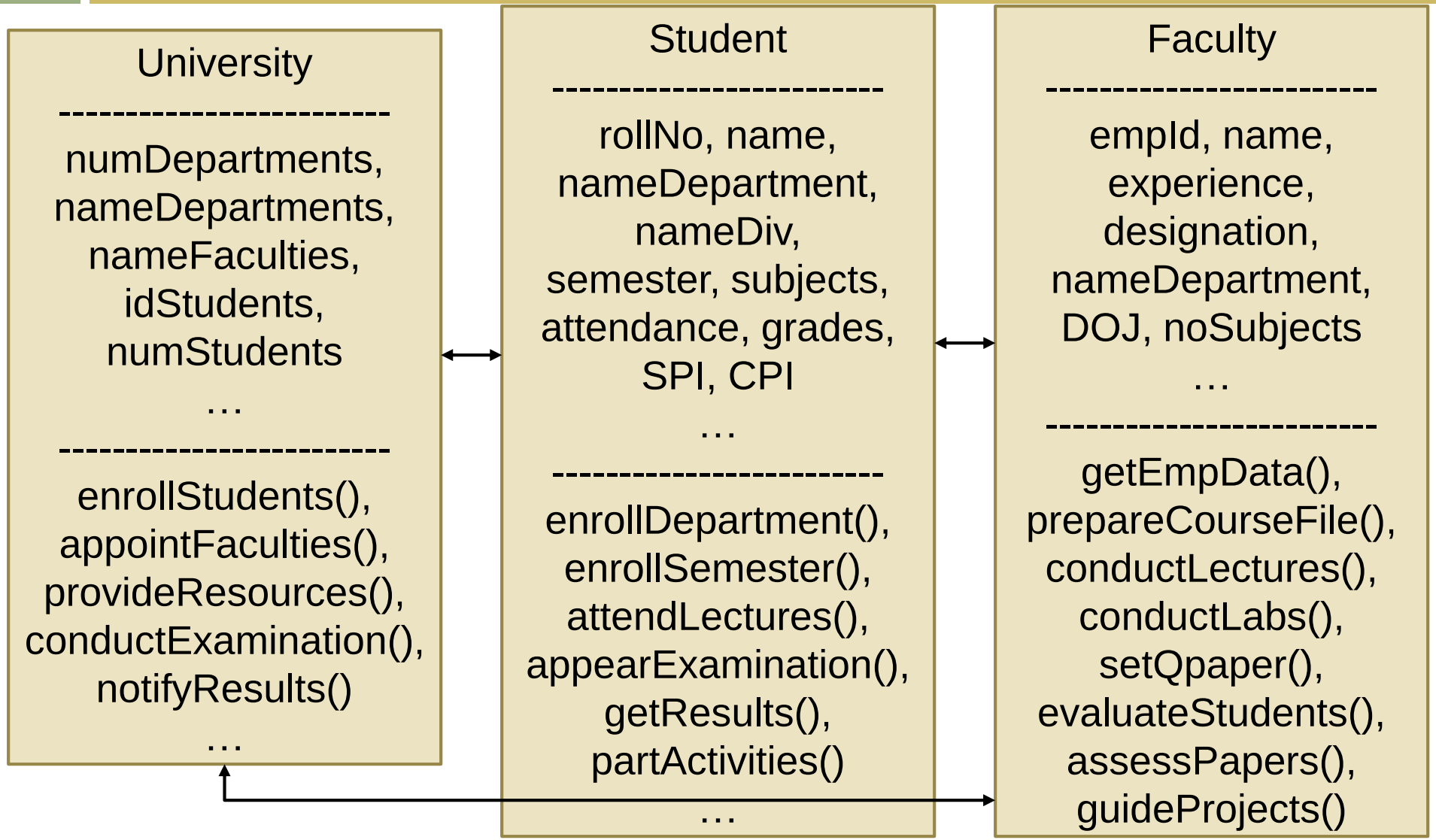
Programming Paradigms – OOP

- Object Oriented Programming
  - It is based on the concept of using classes and its objects.
  - Inspired from the real-world.
- Class: It is a blueprint of the properties & behavior.
  - It is a data-type.
- Object: It is an instance of a particular class.
- Variable and function scope:
  - Public
  - Private
  - etc.

Programming Paradigms – OOP…



Object Oriented Programming- Example



What is Object Oriented Programming?

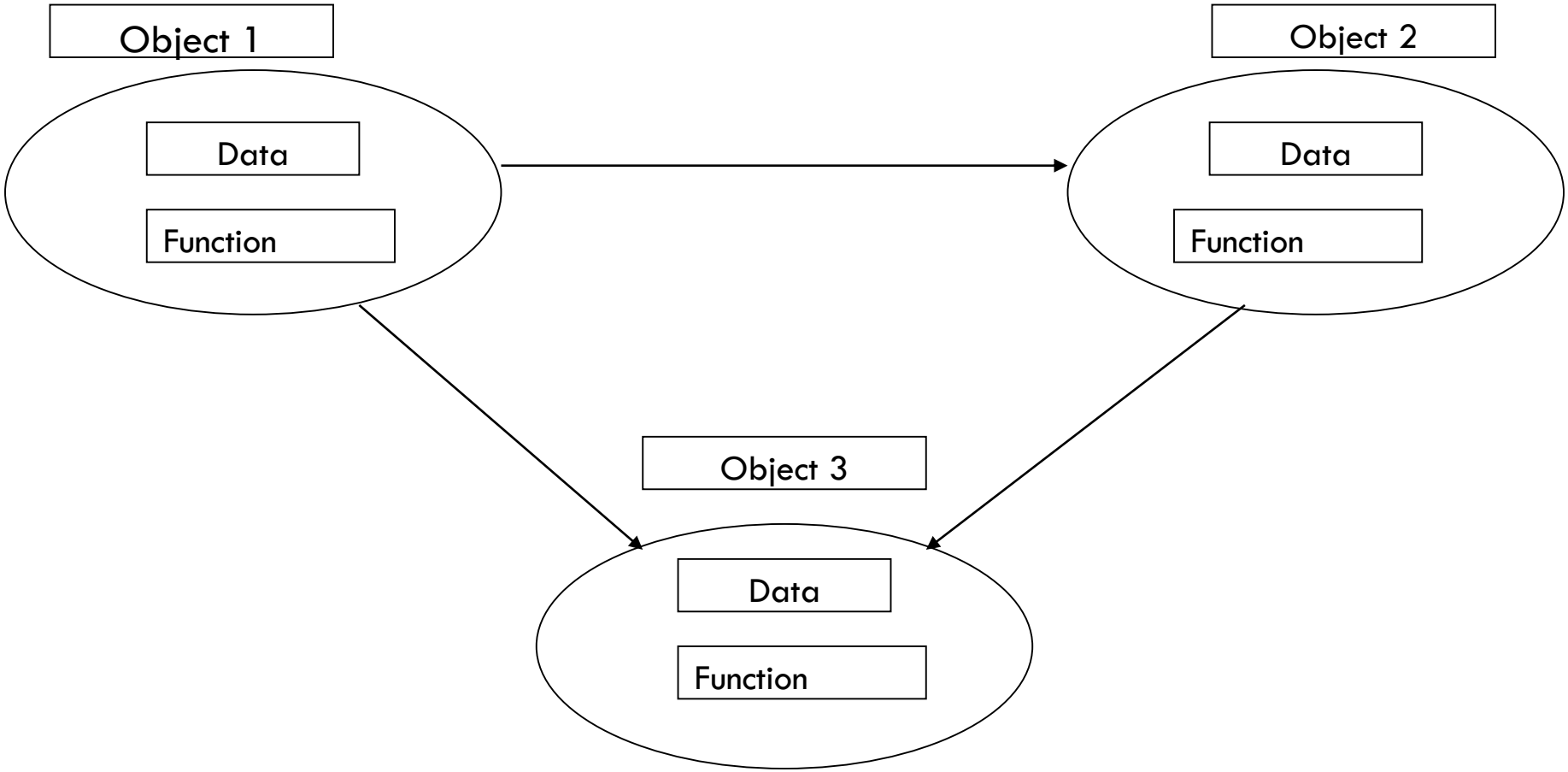
- Identifying objects and assigning responsibilities to these objects.
- Objects communicate to other objects by sending messages.
- Messages are received by the methods of an object
- An object is like a black box.
  - The internal details are hidden.

Programming Paradigms – OOP

- Objects have both data and methods
- Objects of the same class have the same data elements and methods
- Objects send and receive messages to invoke actions

- Key idea in object-oriented:
- The real world can be accurately described as a collection of objects that interact.

Programming Paradigms – OOP…

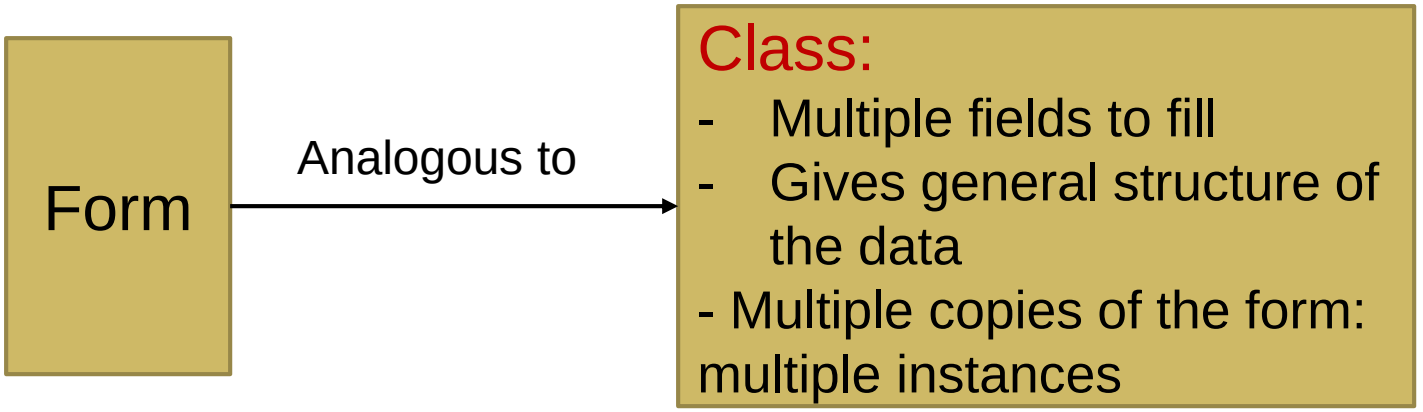


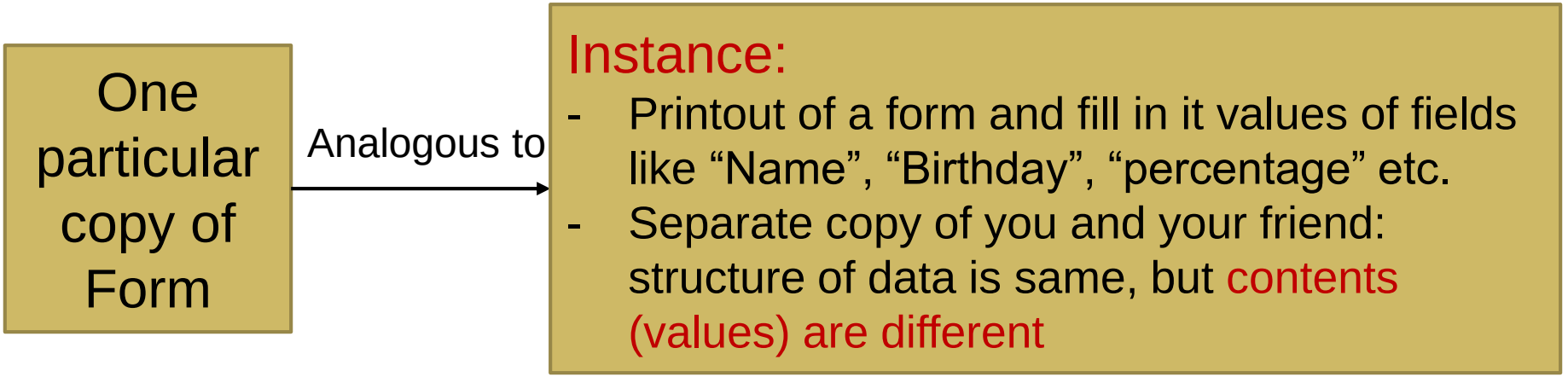
Object and Class- Analogy

- An analogy for Objects and Class: Admission Forms (hard copy)
- The form itself is like the class.
  - It has multiple fields to fill in.
  - You can print multiple copies of the form, just like you can have multiple instances of a class.
  - The class gives the general structure of the data, like a form.
- An instance (object) is one particular copy of the form.
  - When you print out a copy and fill it in, you give values to fields like “Name”, “Birthday”, “Percentage” etc.
  - A single, completed copy of the form is like an instance of the class.
  - You and your friend could each have a different copy of the form: in that case, the structure of the data would be the same, but the content would be different.

Object and Class- Analogy

An analogy for Objects and Class: Admission Forms (hard copy)





Object and Class

- **Object:** An object is a custom data structure that organizes and encapsulates variables and methods into a single data type.
- It is used near-interchangeably with “instance”.
- A single set of values of a particular class.

- **Class:** A custom data type comprised of multiple variables and/or methods.
- Instances or objects are created based on the template provided by the class.
- An instance is a set of values for these variables.

Class

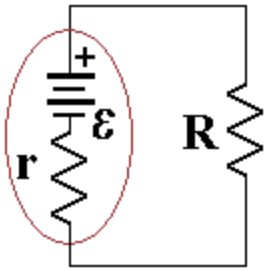
- **Example:**
  - A person would be a single entity that has a lot of variables about them.
    - A first name and a last name.
    - A height, a weight, DOB
    - A hair color, an eye color
    - A phone number, a residential address, an email address
  - These are all variables that we could wrap up into one data type, and we'd call that data type a person class.

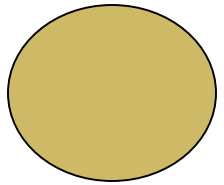
Basic Terminology

- Object:
  - usually a person, place or thing (a noun)
- Method:
  - an action performed by an object (a verb)
- Attribute:
  - description of objects in a class
- Class:
  - a category of similar objects (such as automobiles)
  - does not hold any values of the object's attributes

What is an object?

- Tangible Things as a car, printer, ...
- Roles as employee, boss, ...
- Incidents as flight, overflow, ...
- Interactions as contract, sale, ...
- Specifications as colour, shape, …





Representing Objects

- An object is represented as rectangle

: Professor

Class Name Only

ProfessorSurati

Object Name Only

ProfessorSurati : Professor

Class and Object Name

Class and object

Professor Surati

What is a Class?

- A class is a description of a group of objects
  - having common properties (attributes), behavior (operations or methods), relationships and semantics
  - An object is an instance of a class

- A class is an abstraction in that it
  - Emphasizes relevant characteristics
  - Suppresses other characteristics

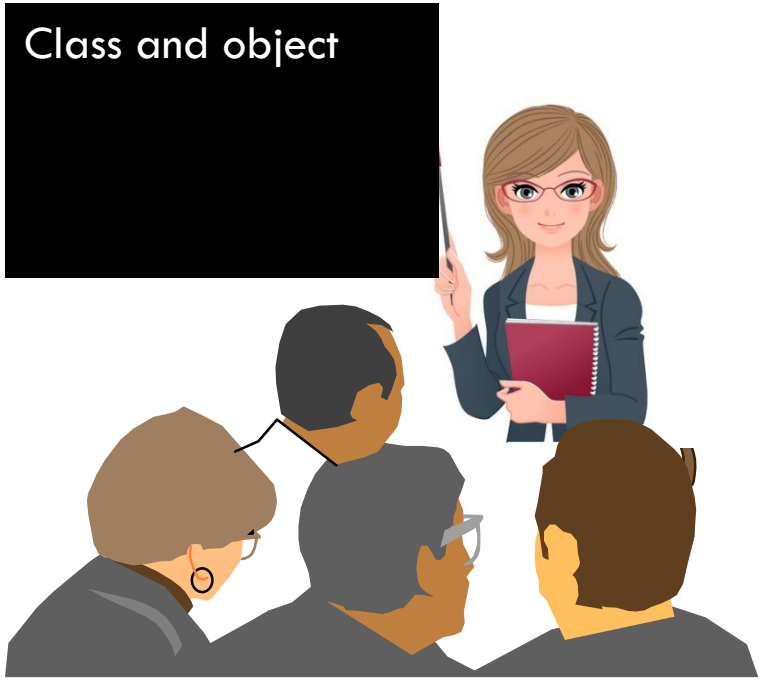
Example Class

Class

Course

Properties

Name
Location
Days offered
Credit hours
Start time
End time

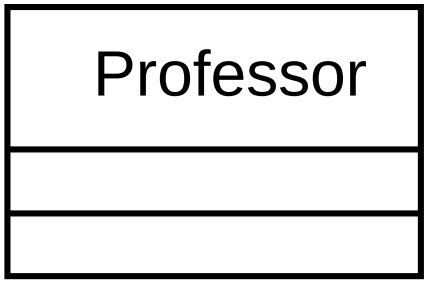


Behavior

Add a student
Delete a student
Get course syllabus
Determine if it is full

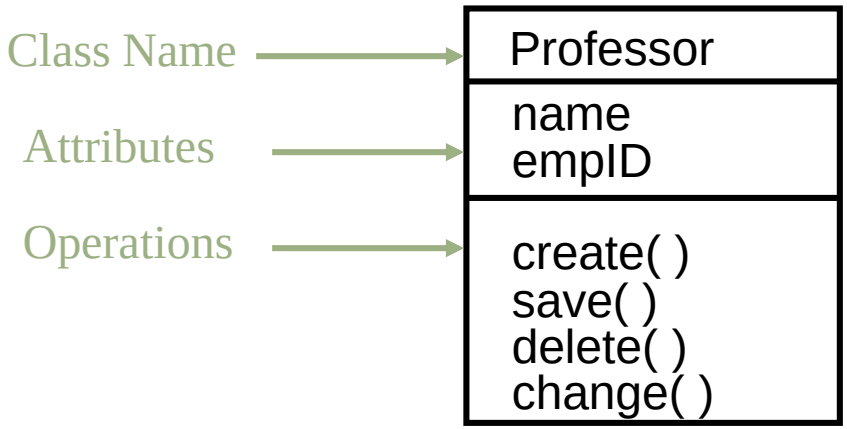
Representing Classes

- A class is represented using a compartmented rectangle



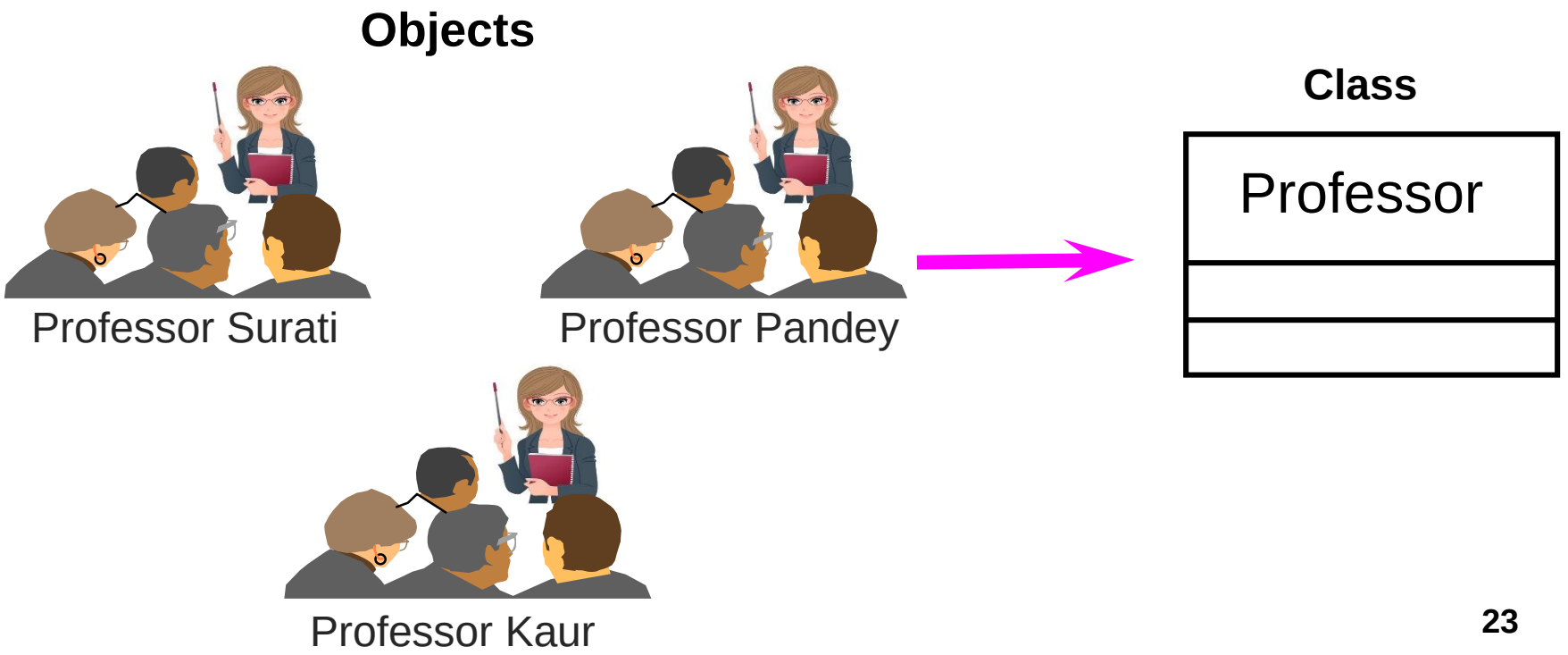
Class Compartments

- A class is comprised of three sections
  - The first section contains the class name
  - The second section shows the structure (attributes)
  - The third section shows the behavior (operations)

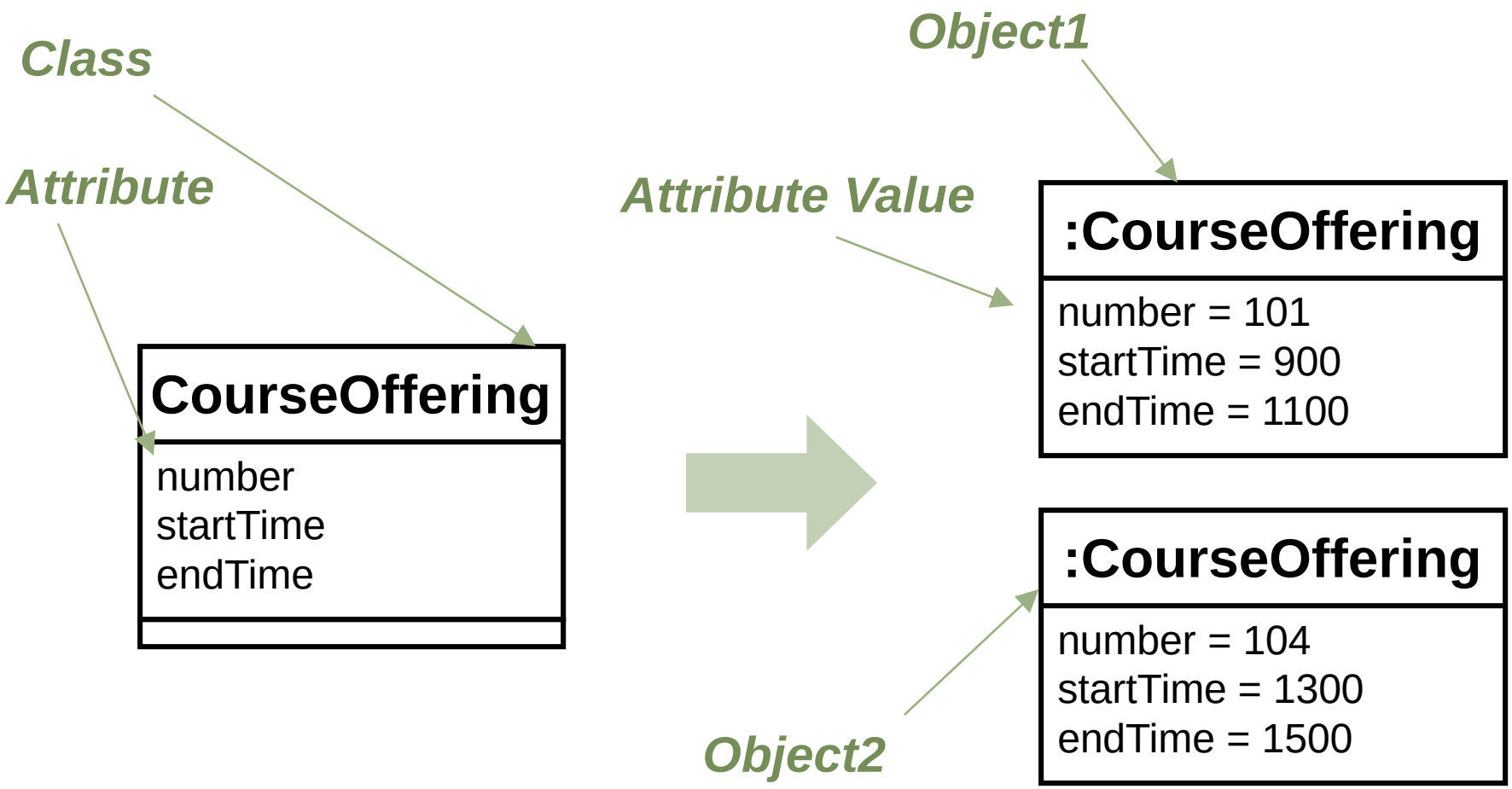


The Relationship Between Classes and Objects

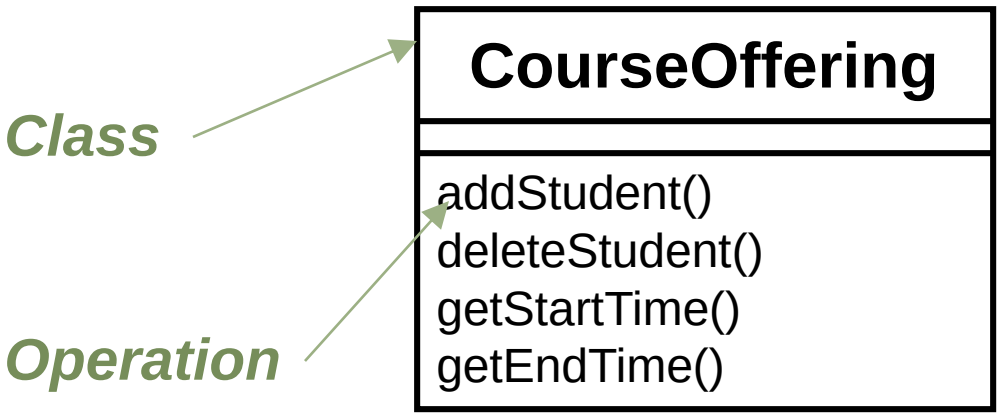
- A class is an abstract definition of an object
  - It defines the structure and behavior of each object in the class
  - It serves as a template for creating objects
- Objects are grouped into classes



What is an Attribute?

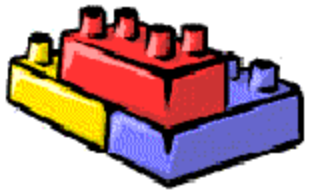


What is an Operation?



Why do we care about objects?

- Modularity - large software projects can be split up in smaller pieces.
- Reusability - Programs can be assembled from pre-written software components.
- Extensibility - New software components can be written or developed from existing ones.



OOP Introduction





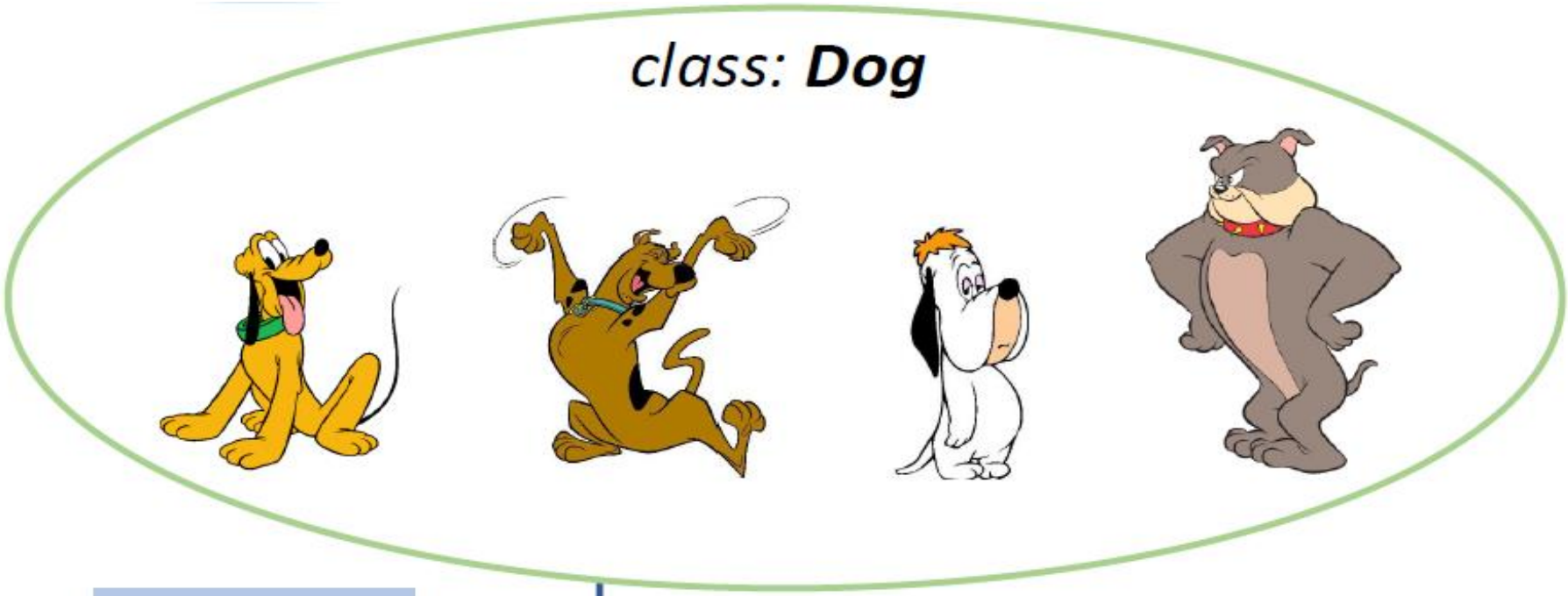


Name	Pluto	Scooby Doo	Droopy	Spike
Skin Color	Yellow	brown	white	grey
Ear length	long	short	long	short
Is spotted	no	yes	no	no

Attributes

Values

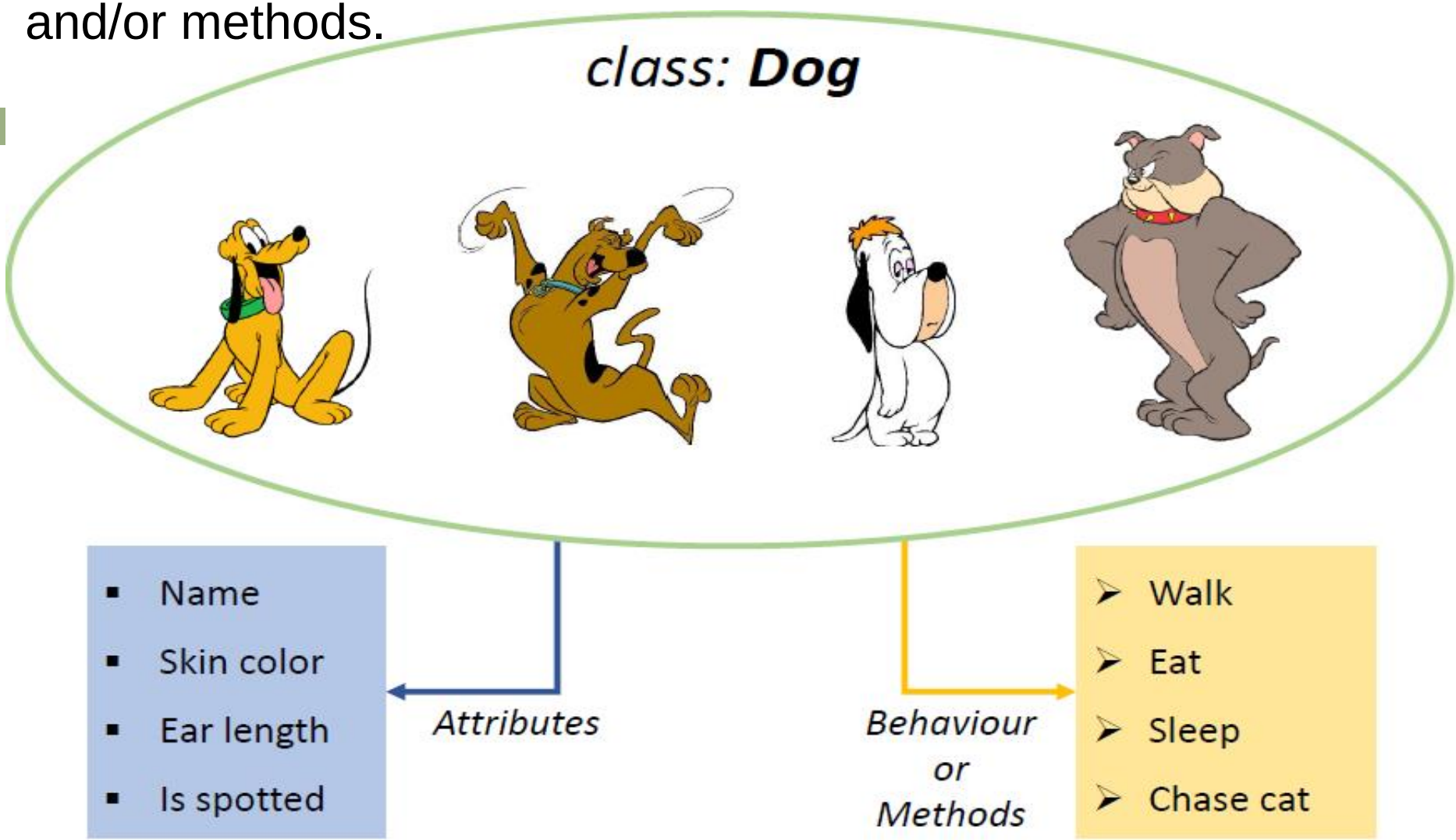
class: ***Dog***



- Name
- Skin color
- Ear length
- Is spotted

Attributes

Class: A custom data type comprised of multiple variables and/or methods.



class: ***Dog***

- Name
- Skin color
- Ear length
- Is spotted

- *Walk*
- *Eat*
- *Sleep*
- *Chase cat*

Objects *of the* ***class*** *Dog*

Object: An object is a custom data structure that organizes and encapsulates variables and methods into a single data type.

class: *Dog*

- Name
- Skin color
- Ear length
- Is spotted

- *Walk*
- *Eat*
- *Sleep*
- *Chase cat*

Name	Pluto
Skin Color	Yellow
Ear length	long
Is spotted	no

Name	Scooby Doo
Skin Color	brown
Ear length	short
Is spotted	yes

Name	Droopy
Skin Color	white
Ear length	long
Is spotted	no

Name	Spike
Skin Color	grey
Ear length	short
Is spotted	no

class: ***Dog***

- Name
- Skin color
- Ear length
- Is spotted

- *Walk*
- *Eat*
- *Sleep*
- *Chase cat*

New

Name	-
Skin Color	-
Ear length	-
Is spotted	-

class: ***Dog***

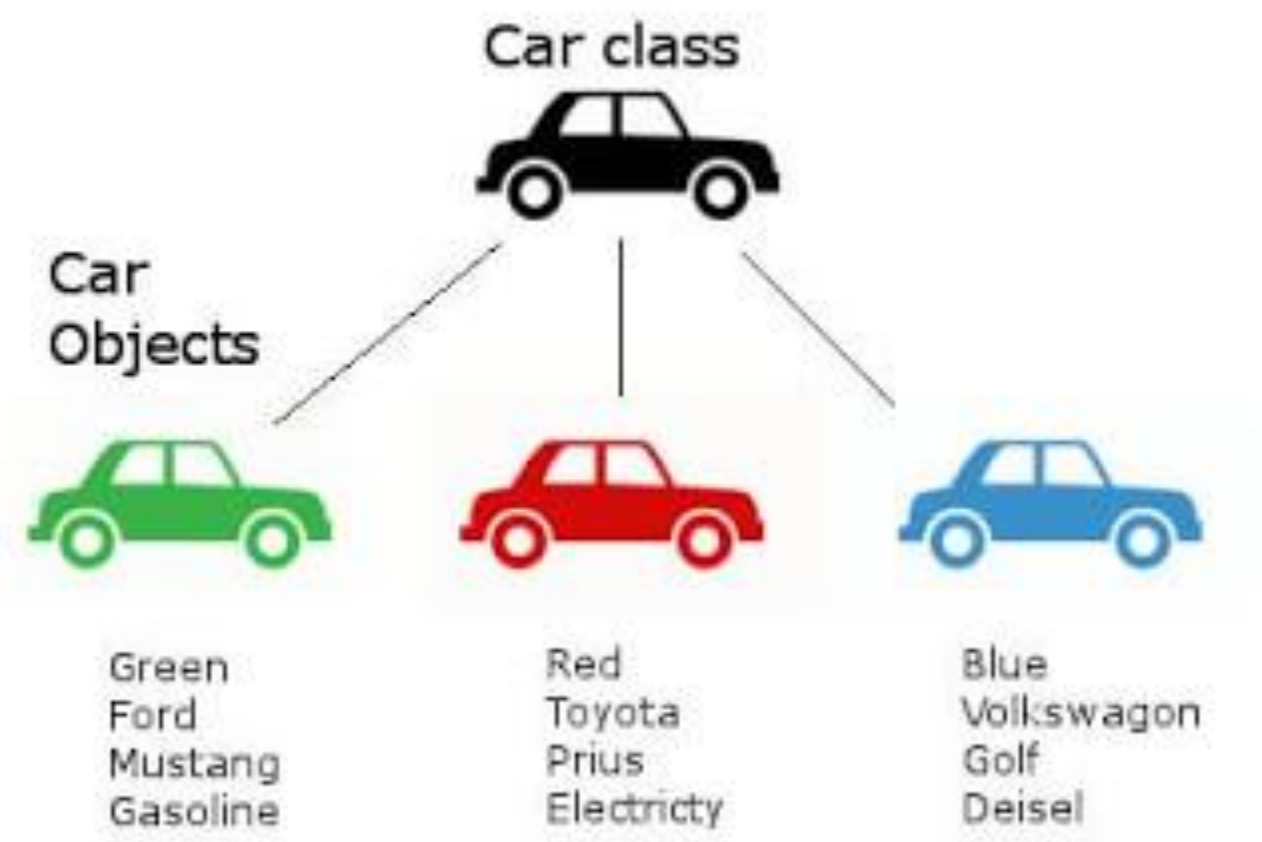
- Name
- Skin color
- Ear length
- Is spotted

- *Walk*
- *Eat*
- *Sleep*
- *Chase cat*

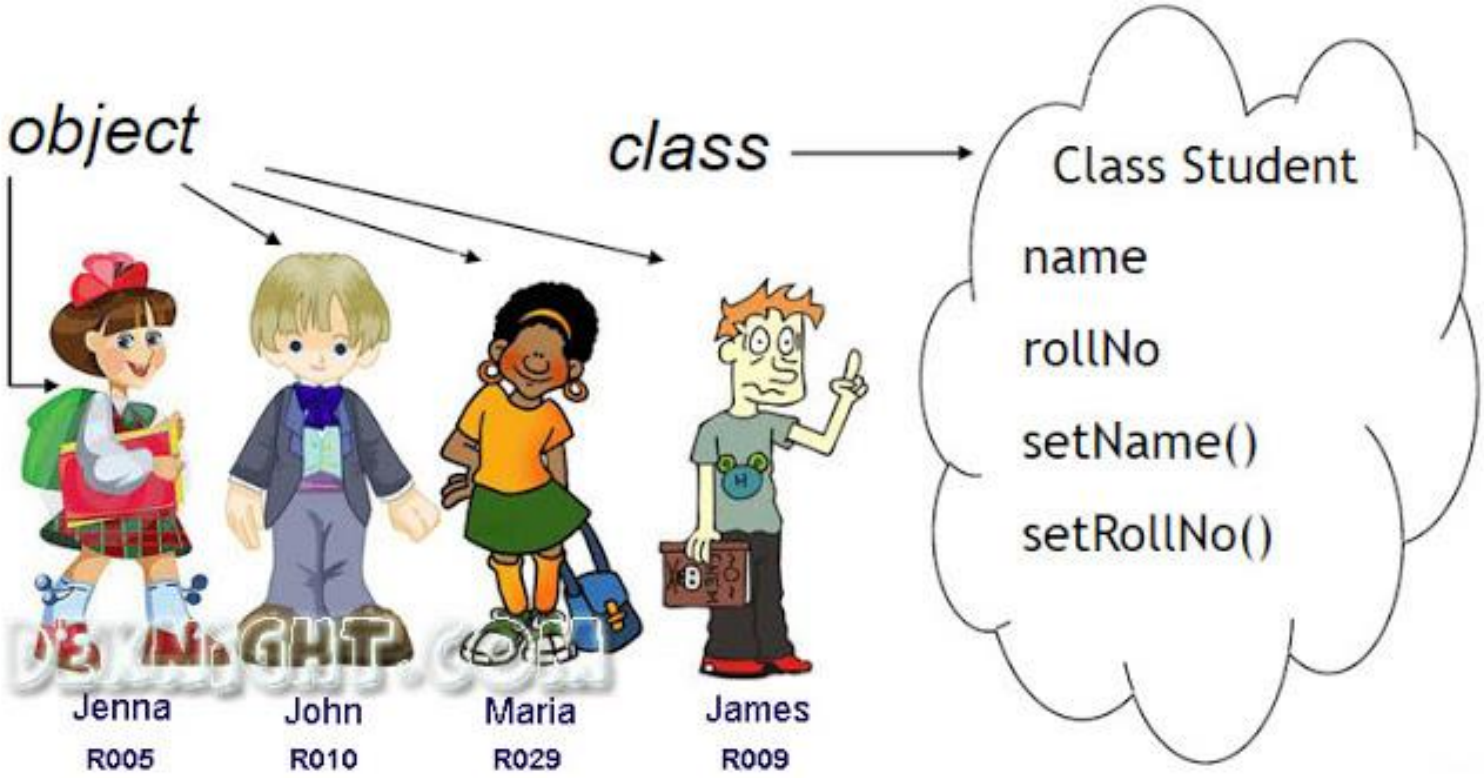
New

Name	Mr. Vodafone
Skin Color	cream
Ear length	short
Is spotted	no

Another Example



Example


object
class
Class Student
name
rollNo
setName()
setRollNo()
Jenna
R005
John
R010
Maria
R029
James
R009

Example

Class : Cutter

Objects

COMBINATION PLIERS

WIRE STRIPPER AND CUTTER

TRIMMING PLIERS

CRIMPING PLIERS

MULTIGRIPS

LONGNOSE PLIERS

LONGNOSE PLIERS

Example

Class : Hammer

Objects

Raw-hide headed hammer

Lead hammer

Double-headed hammer

Ball peen hammer

Cross peen hammer

Straight peen hammer

Exercise

- Each of the following pairs represent a class-instance pair:
- In each pair, select which option is best described as a class?
- **Set 1:**
  - A pet
  - My Cat, Boggle
- **Set 2:**
  - My daughter, Lucy
  - A person
- **Set 3:**
  - A beverage
  - The can of soda, Lucy drinking right now.