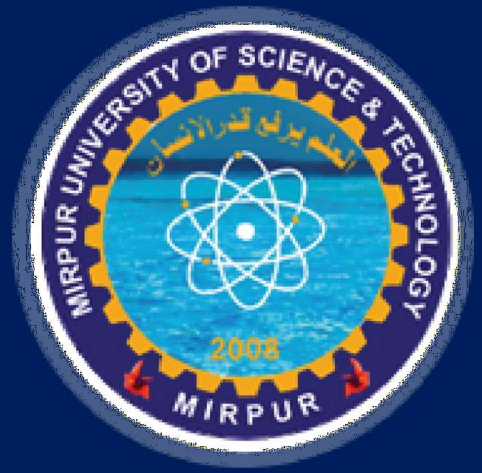

MUST

Wisdom & Virtue

MIRPUR UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF SOFTWARE ENGINEERING

Object Oriented Programming

Lecture 7 : Inheritance in OOP

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Lecturer

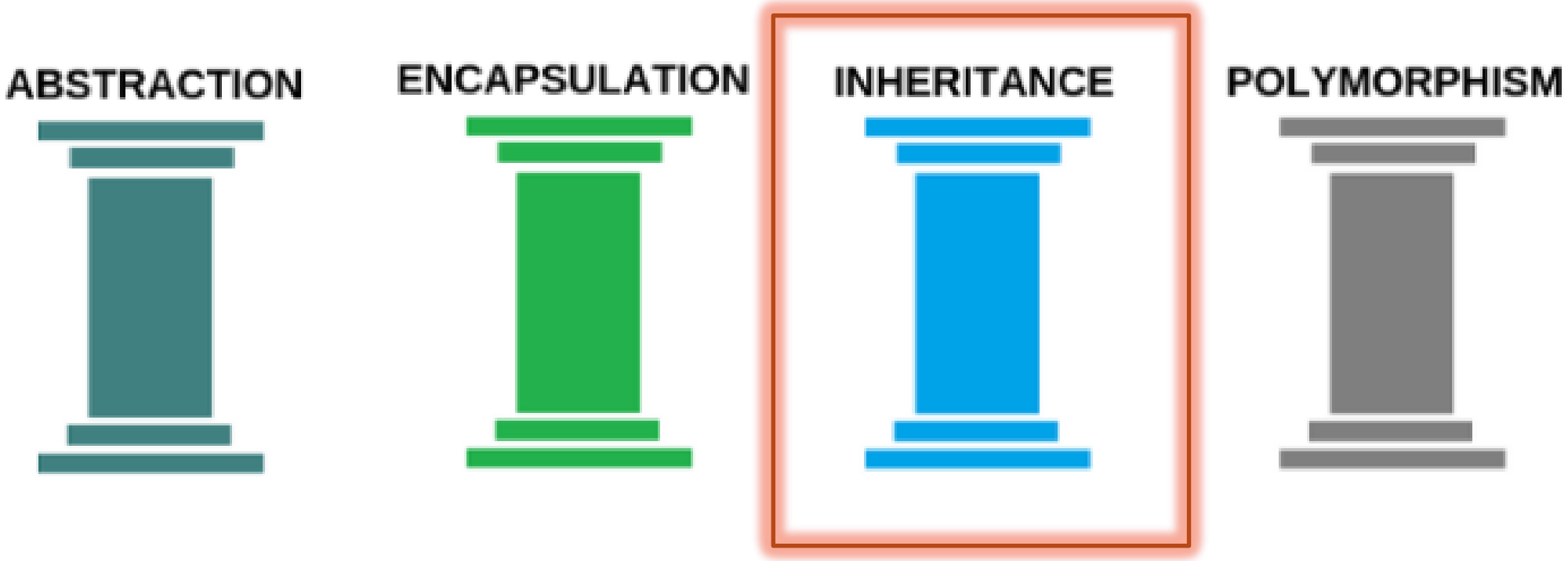
Last Lecture

- Encapsulation in OOP
- Accessor functions
- Avoiding Error using Accessor functions
- Read-only Property

This Lecture

- Inheritance in OOP
- How to implement inheritance in C#
- Advantages of inheritance

Four Pillars of OOP



Inheritance

Inheritance (Real World)

- A child **inherits** characteristics of parents
- Besides inherited characteristics, a child may have **own unique** characteristics

Inheritance in OOP

Inheritance in Classes

If a class **B** inherits from class **A** then it contains all the characteristics (information structure and behaviour) of class **A**

The parent class is called ***base*** class and the child class is called ***derived*** class Besides inherited characteristics, derived class may have its own unique characteristics

Inheritance in Classes

- **What is child class?**

A class that inherits another class is known as child class, it is also known as **derived class** or **subclass**.

- **What is parent class?**

The class that is being inherited by other class is known as parent class, **super class** or **base class**.

Inheritance Example

In problem statement when two objects show is a relation ship, then it reflects inheritance

Problem Statement

- A calculator can perform addition, subtraction , division and multiplication.
- Scientific calculator is a calculator that can also perform trigonometry operations.

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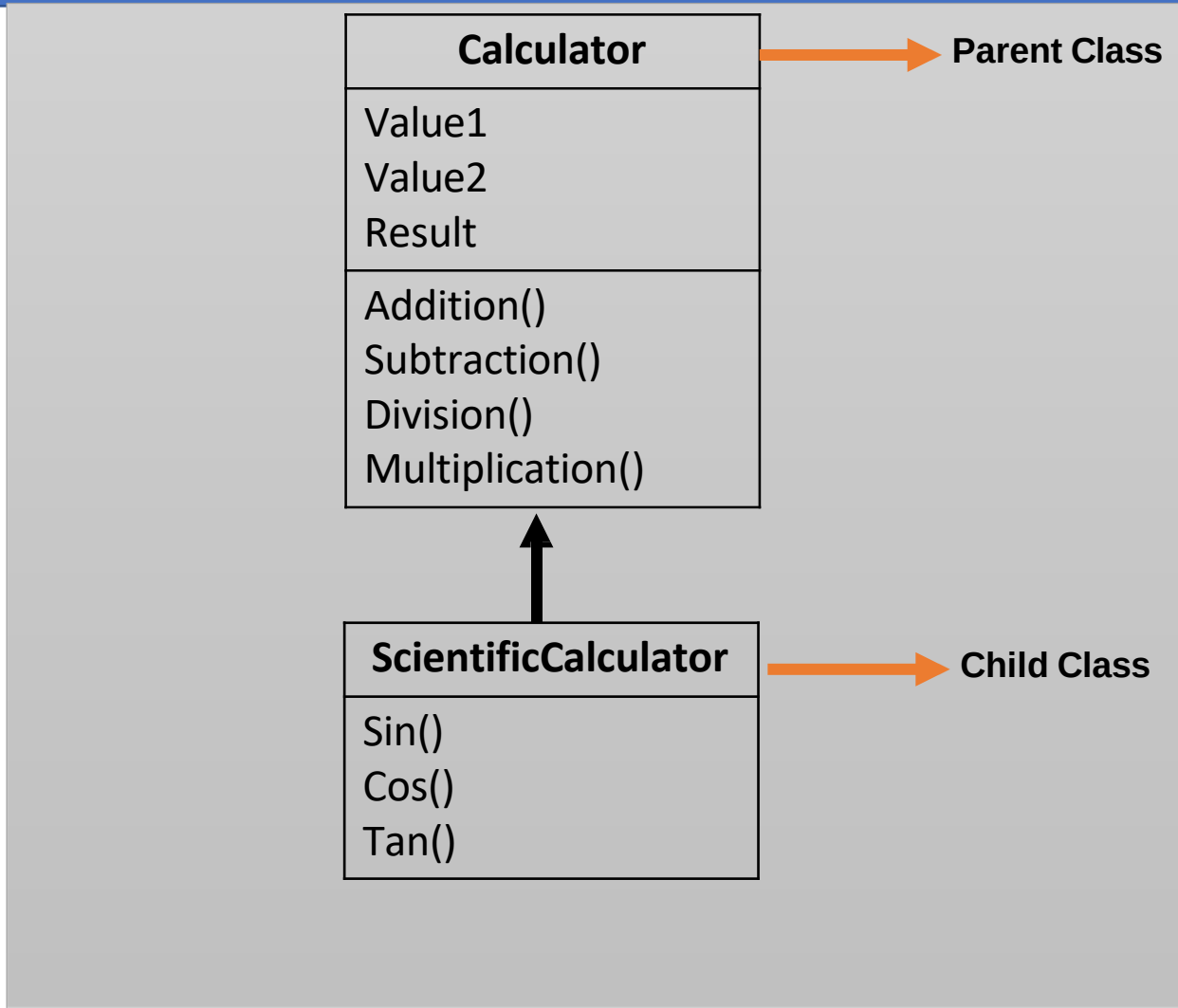
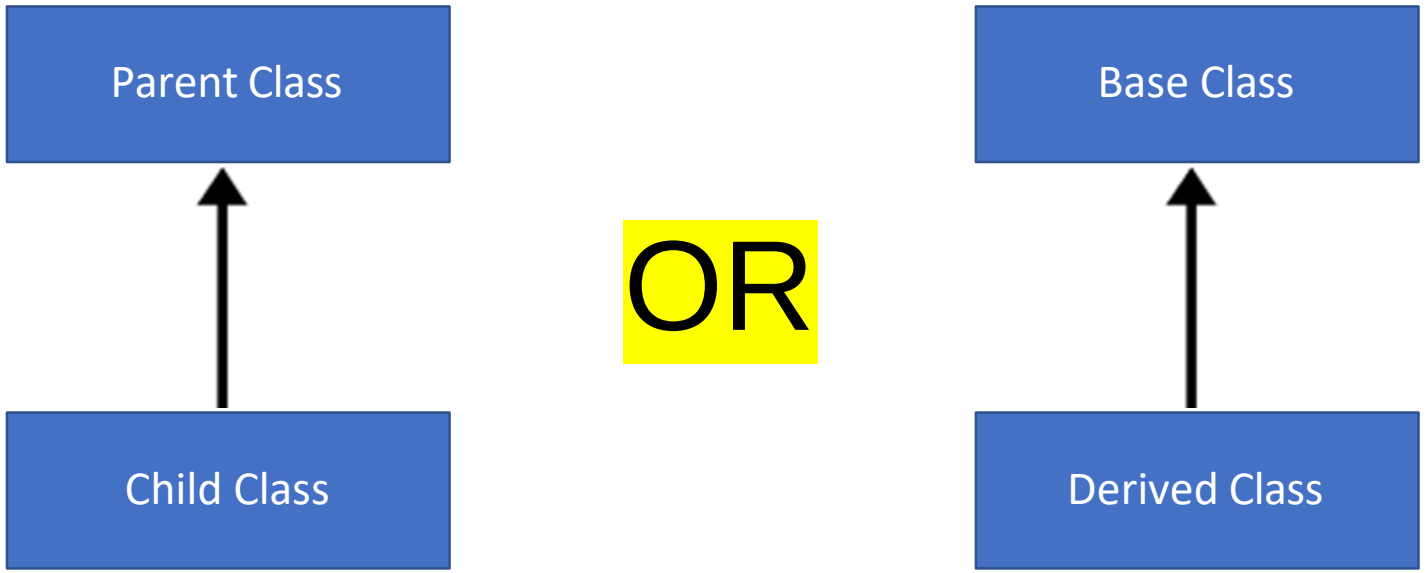


Inheritance represents “IS A” relationship

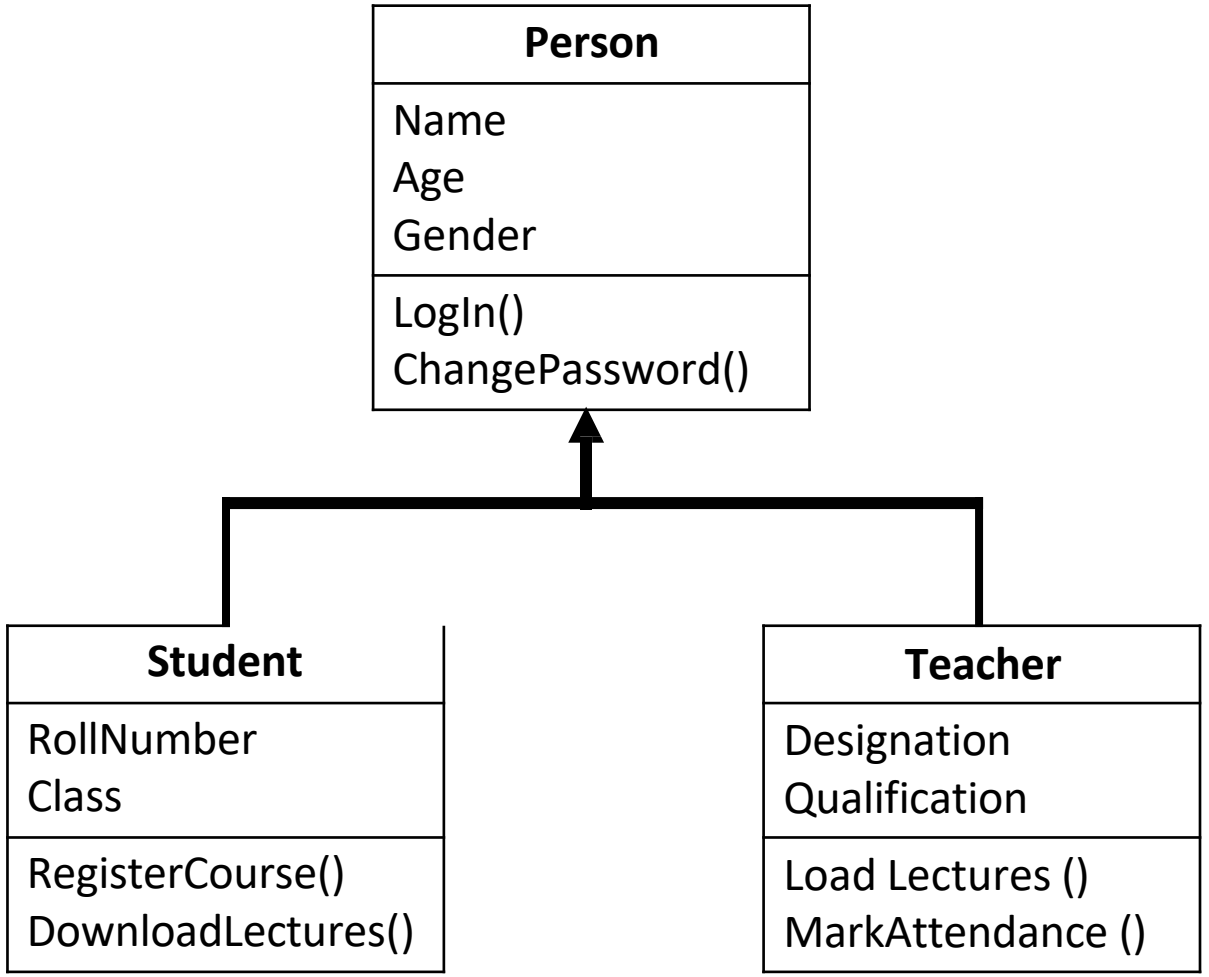
- Inheritance represents “IS A” relationship
  - for example “a Scientific Calculator **IS A** Calculator with additional features”.
- In general words we can say that inheritance represents,
    - *“**Derived** class **IS A** kind of **Parent** class”*

UML Notation

- We use arrow from **child** class (derived class) to the **parent** class (base class) to show inheritance as shown below



Here
Student IS A Person
Teacher IS A Person



Syntax (C#)

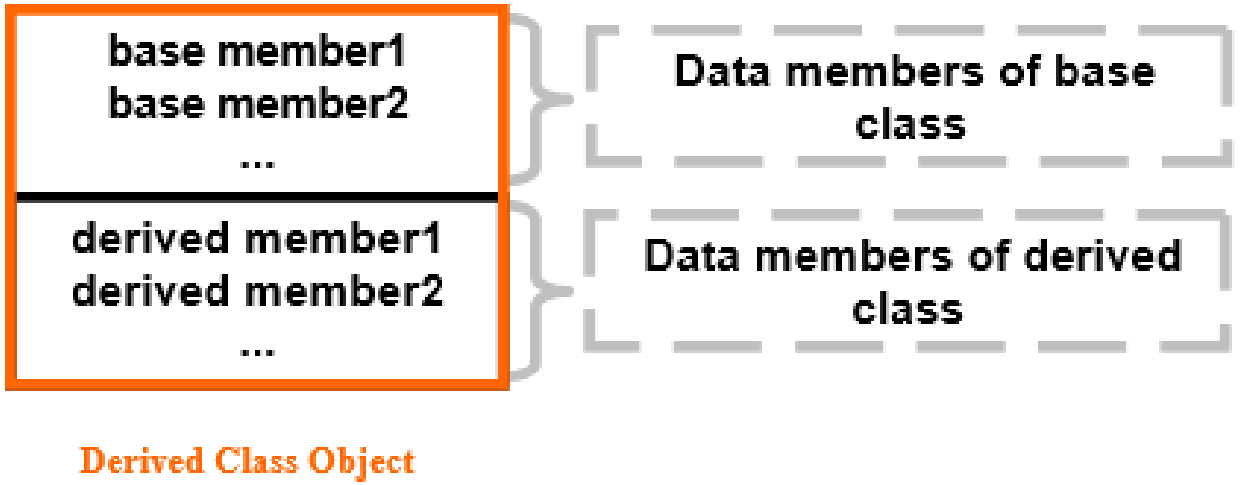
```
class parent_class
{
    //Body of parent class
}
class child_class : parent_class
{
   //Body of child class
}
```

Class Task 01

- **Create a base class** called Calculator with:
- A method add(a, b) that returns the sum of a and b
- A method subtract(a, b) that returns the difference
- **Create a derived class** called AdvancedCalculator that inherits from Calculator:
- Add a method multiply(a, b) that returns the product
- Add a method divide(a, b) that returns the quotient
- **Create an object** of AdvancedCalculator and perform all four operations:
- add(10, 5)
- subtract(10, 5)
- multiply(10, 5)
- divide(10, 5)

Allocation in Memory

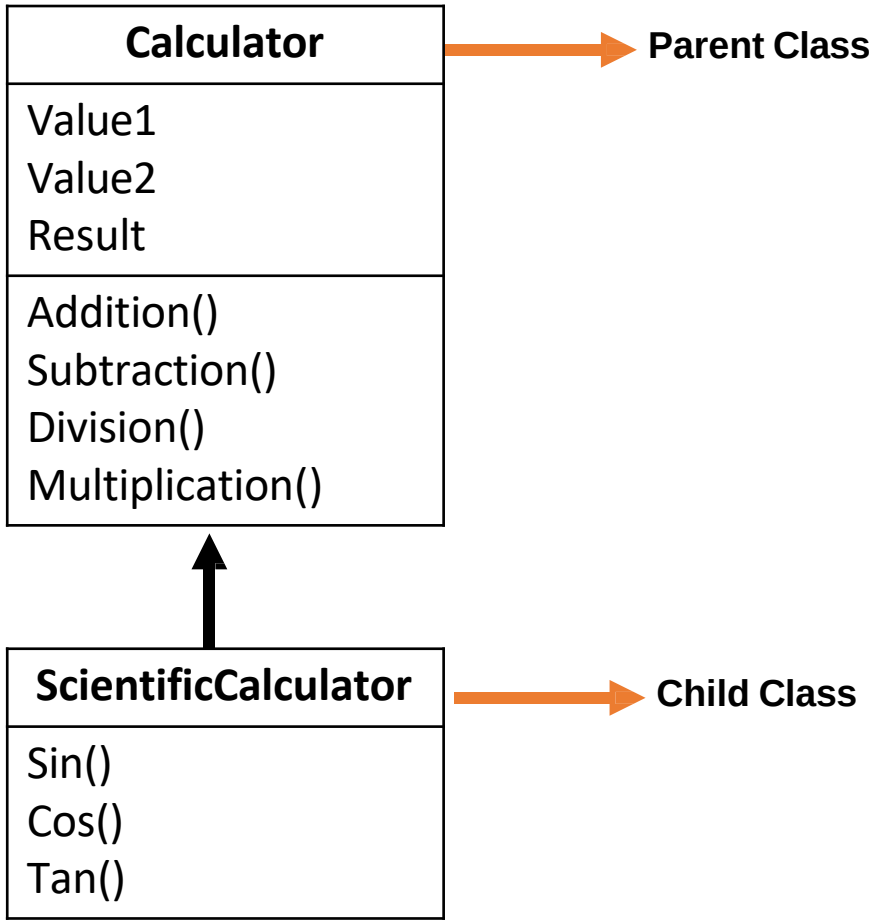
- The object of derived class is represented in memory as follows



- Every object of derived class has an anonymous object of base class

Example

- ScientificCalculator obj = new ScientificCalculator;
- When object of ScientificCalculator class will be created then automatically an object of Calculator class will also be created.



Inheritance – Advantages

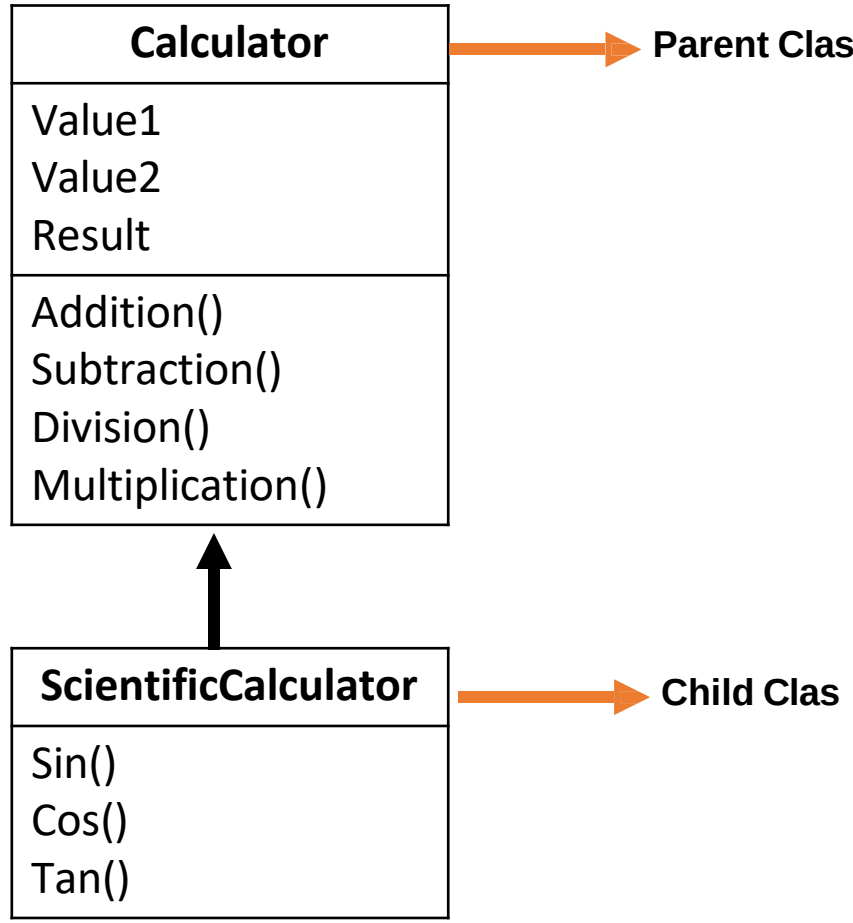
Reuse

Less redundancy

Increased maintainability

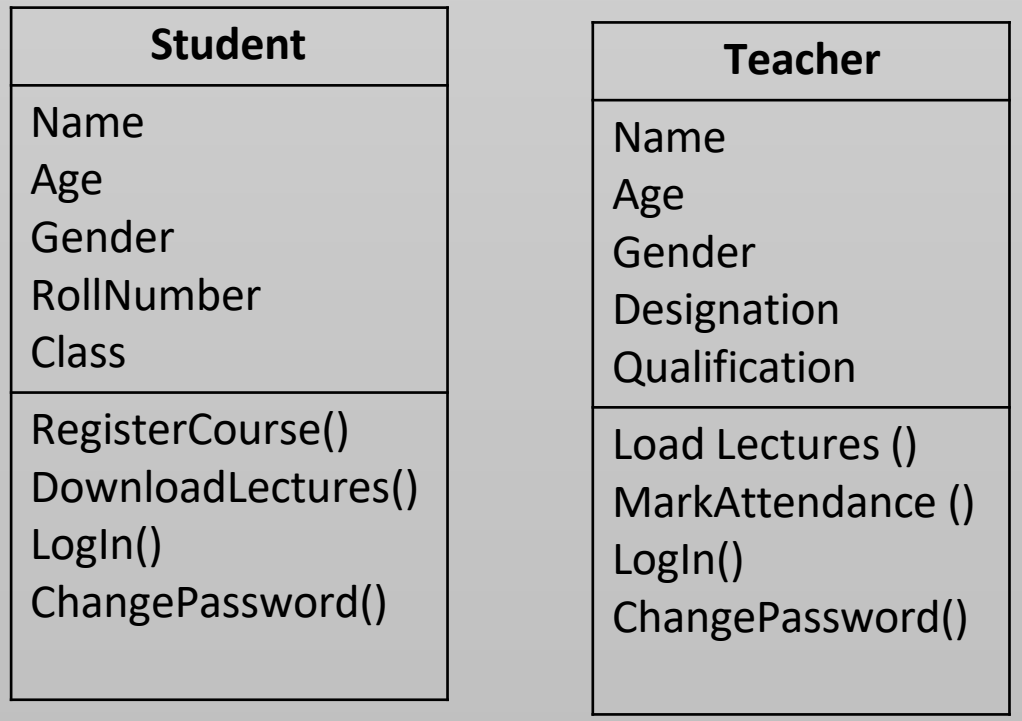
Reuse with Inheritance

- The main advantages of inheritance are **code reusability**.
- When child class inherits the properties and functionality of parent class, we need not to write the same code again in child class.
- This makes it easier to reuse the code, makes us write the less code and the code becomes much more readable.



Less Redundancy with Inheritance

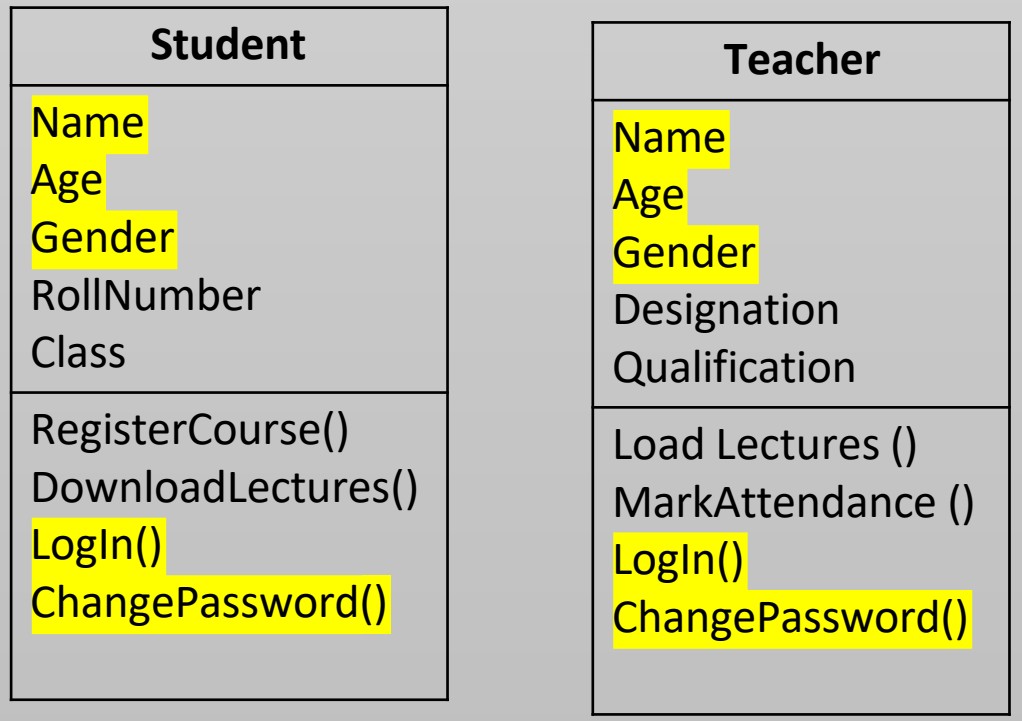
Without Inheritance



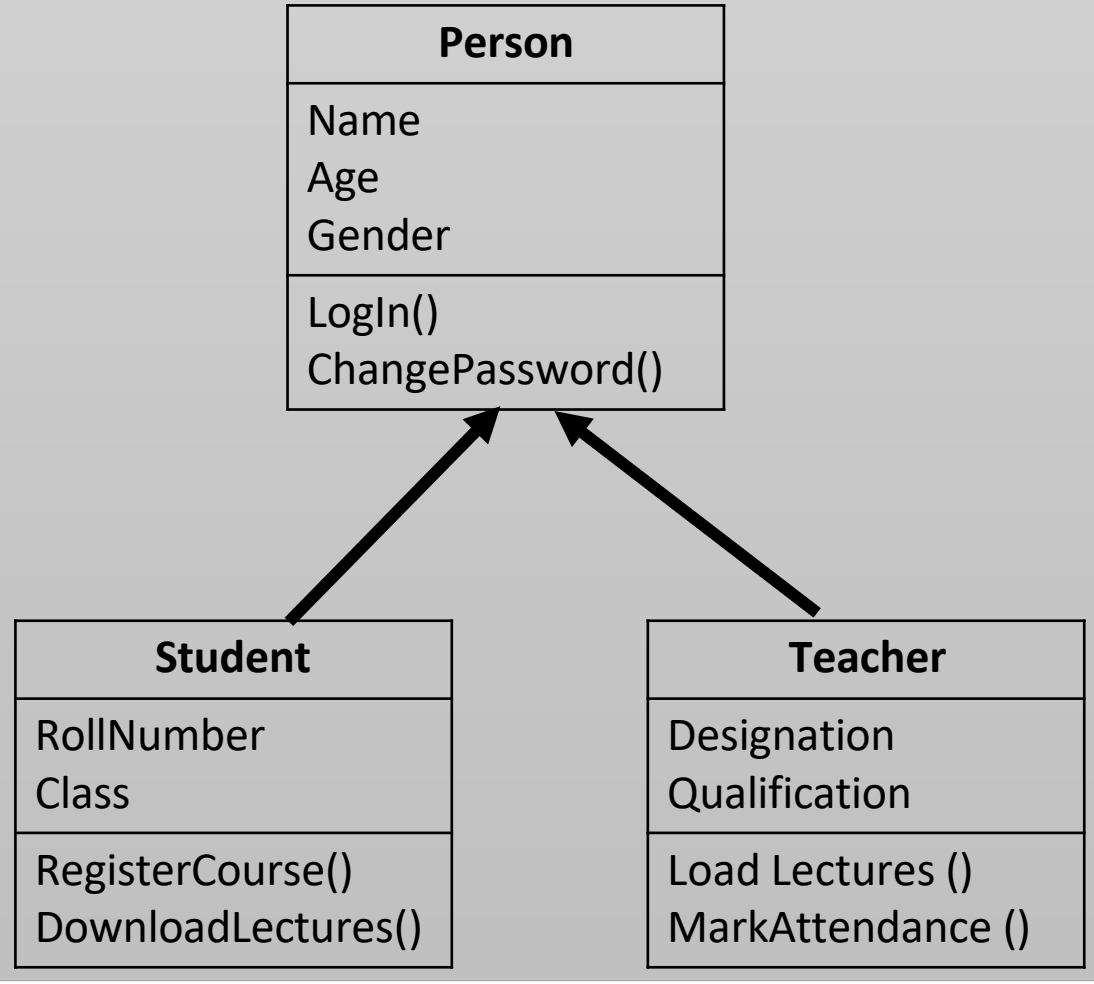
Less Redundancy with Inheritance

Without Inheritance

Redundant Data

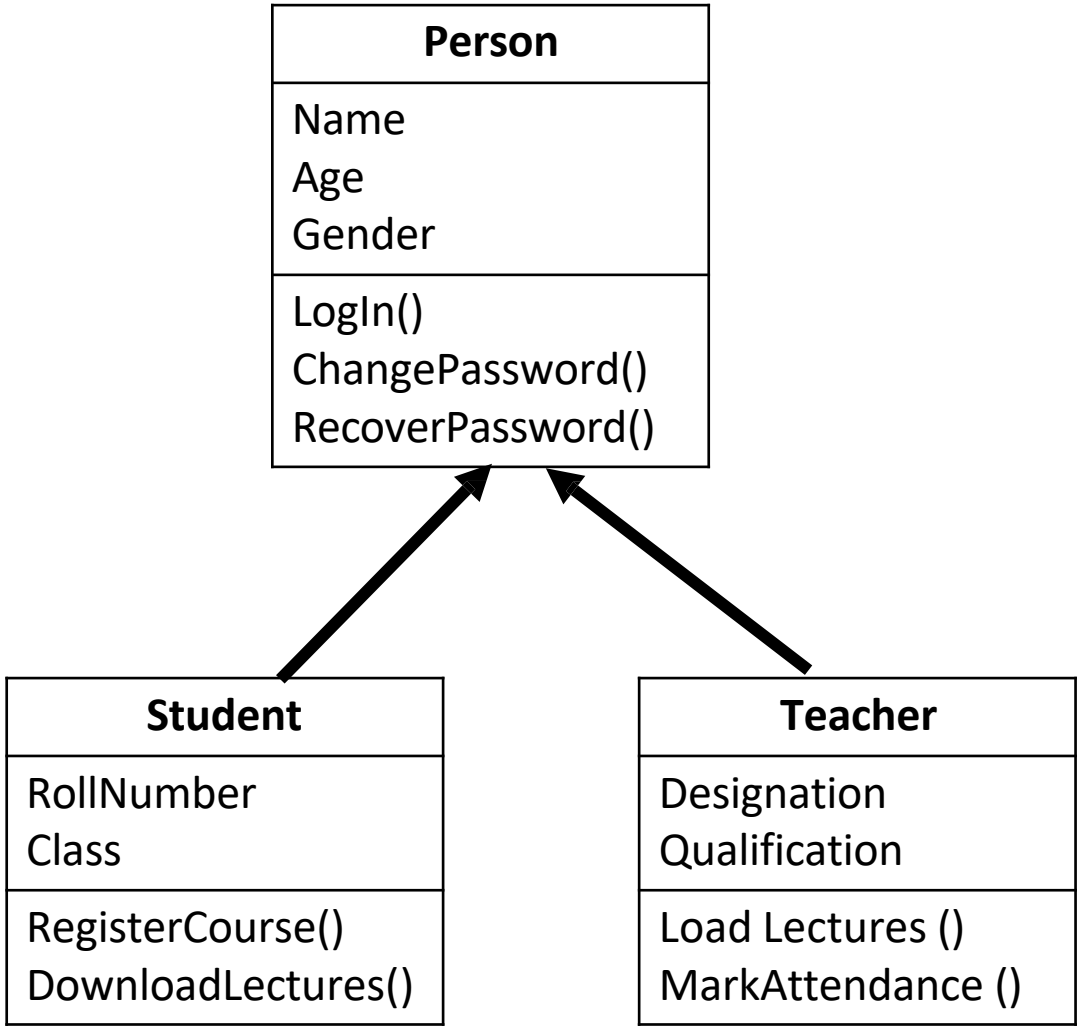


With Inheritance



Increased Maintainability with Inheritance

- Let say we want to update the implementation of **Recover Password**.
- Previously the password was recovered based on secrete questions.
- Now you wanted to recover password based on code sent on the registered mobile number.
- In inheritance only change in parent class will be effectively reflected in all base classes. In this way inheritance make it easy to maintain any change or upgradation in code



References

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- Object Oriented Programing , Virtual University , Lecture 22, Online Available at: https://ocw.vu.edu.pk/CourseDetails.aspx?cat=Computer+Science%2FInformation+Technology+&course=CS304

THANKS