OBJECT ORIENTED PROGRAMMING

Inheritance

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Content Overview

- What is Inheritance?
- Types of Inheritance
- Inheritance represented in a class diagram
- Superclass (Parent) and Subclass (Childs)

Learning Objectives

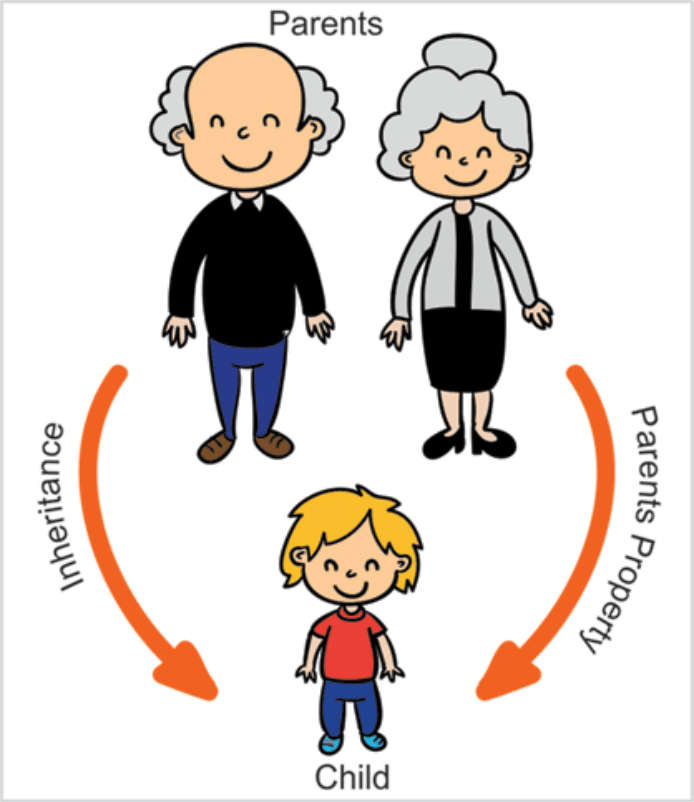
- To understand the basic concept of Inheritance
- To differentiate between inheritance types
- To define a child class in Java using `extends` keyword

REVIEW : INHERITANCE

- It enables objects to **inherit attributes and behaviors** from other objects
- Classes with properties in common can be grouped so that their common properties are only defined once
- **Superclass Vs. Subclass**

ADVANTAGE

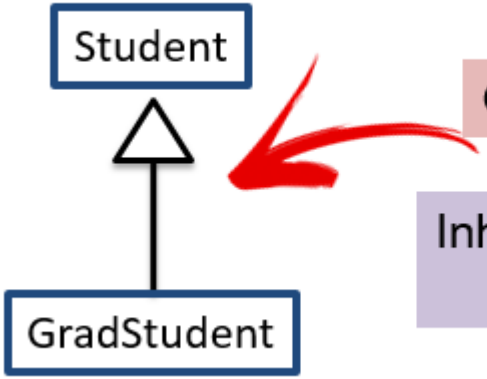
- Reduce the amount of new code that must be designed, written and tested each time a new program is develop



WHY?

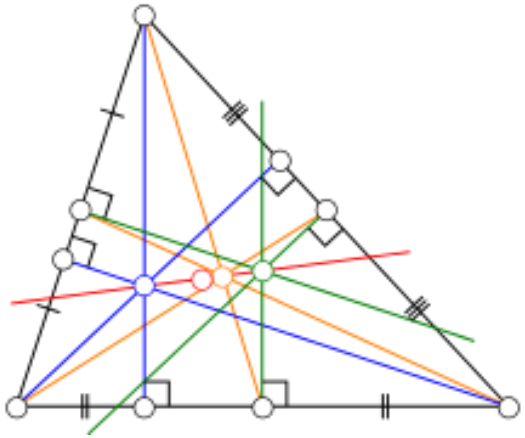
- The programmer can add new variables or methods to adjust a derived class or can even modify (override) the inherited ones

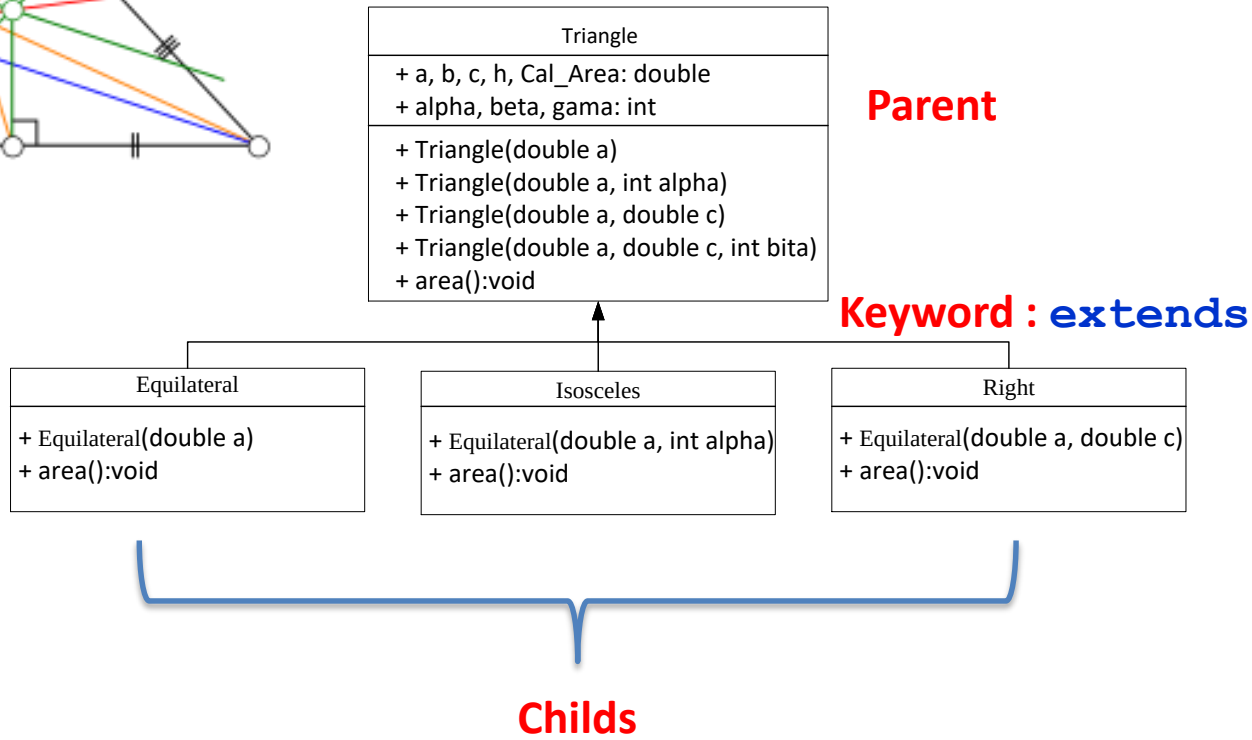
- Reduce the effort to design, implementation and testing new software by reusing the existing software components to create new ones.



Graphically shown the inheritance relationship

Inheritance creates an *is-a* relationship;
Child *is a* more specific version of the parents





Example:

```
class Equilateral extends Triangle
class Isosceles extends Triangle
class Right extends Triangle
```

TYPES OF INHERITANCE

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Single

- A child class can be derived from a single/one parent class only
- Supports by JAVA ✓
- A parent class cannot access attributes and behavior of a child class.

Multiple

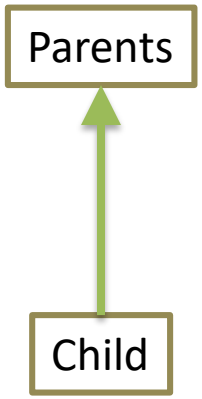
- A child class can be derived from more than one parent class
- Not support in JAVA ✗

INHERITANCE WITH JAVA

How to define a class is a child of a parent class?

1. Use the Java `extends` keyword

2. A child `extends` from a parents because …..
   it inherits properties from the parent and can add more new properties of its own.



THE extends KEYWORD

Syntax:

```
Class <ChildClassName>  extends  <ParentClassName>
{
      // data & methods specific to child
}
```

Example:

```
Class GradStudents  extends  Students
{
      // data & methods specific to child
}
```

HOW?

1. Define the Parent Class : Student

Student
- name : String - age : int
+ setName (String) : void + setAge (int) : void + getName ( ) : String + getAge ( ) : int

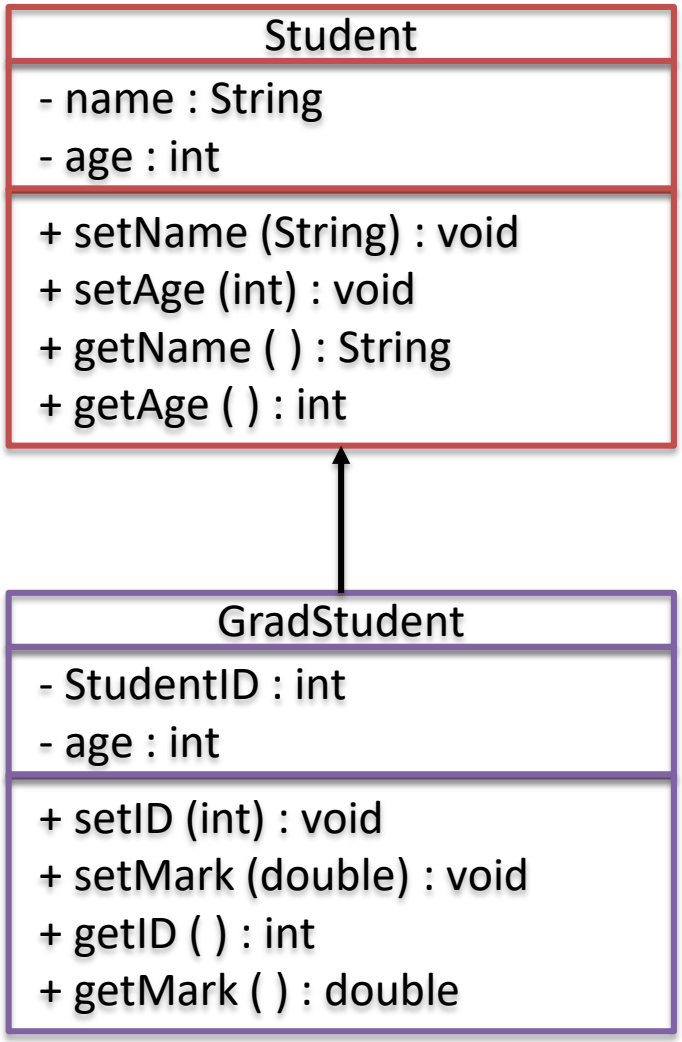
```
public class Student {

        private String name;
        private int age;
        public void setName (String name)
        {
                this.name = name;
        }
        public void setAge (int age) {
                this.age = age;
        }
        public String getName ( ) {
                return name;
        }
        public int getAge ( ) {
                return age;
        }
```

HOW?

2. Define the child Class : GradStudent

```
public class GradStudent extends Student
 {
      private int studentID;
      private double mark;
      public void setID (int matric)
      {
             this.studentID = matric;
      }
      public void setMark (double mark) {
             this.mark = mark;
      }
      public int getID ( ) {
             return studentID;
      }
      public int getMark ( ) {
             return mark;
      }
```



HOW?

3. Write a test program (or the main)

```
public class TestProgram {
    public static void main (String [ ] args) {
        Student s1 = new Student ( );
        GradStudent g1 = new GradStudent ( );
        s1.setName ("Ammar");
        s1.setAge (28);
        g1.setName ("Amira");
        g1.setAge (19);
        g1.setID (01889);
        g1.setMark (95);

        System.out.println ("Student name is " + s1.getName());
        System.out.println ("Student age is " + s1.getAge());
        System.out.println ("GradStudent name is " + g1.setName());
        System.out.println ("GradStudent age is " + g1.getAge());
        System.out.println ("GradStudent ID is " + g1.getID());
        System.out.println ("GradStudent mark is " + g1.getMark());
    }
```

HOW?

Output

```
run :
Student name is Ammar
Student age is 28
GradStudent name is Amira
GradStudent age is 19
GradStudent ID is 01889
GradStudent mark is 96.0
BUILD SUCCESSFUL (total time: 1 second)
```

INHERITANCE : Constructor

- Used `super` keyword to refer to the parent class and often used to invoke the parent's constructor
- A child's constructor is responsible for calling the parent's constructor
- To call the parent's constructor – the first line of child's constructor can be the `super` keyword.
- The `super` keyword can also be used to reference other variables and method defined in the parent's class

```
super ( );
```

Used to call the constructor from superclass (parents) with appropriate arguments

INHERITANCE : Overriding Methods

- A child class can override the definition of an inherited method in favor of its own.
- The new method must have the SAME SIGNATURE (name and parameters) as the parent's method BUT can have a DIFFERENT BODY (implementation
- The type of the object executing the method determines which version of the method is invoked

```
super ( );
```

- Invoked explicitly the parents method using `super` reference.
- Method with `final` modifier, cannot be overridden.
- *Shadowing variables* is when an overriding concept applied to data and should be avoided – cause unnecessarily confusing code.

INHERITANCE : Overriding Methods

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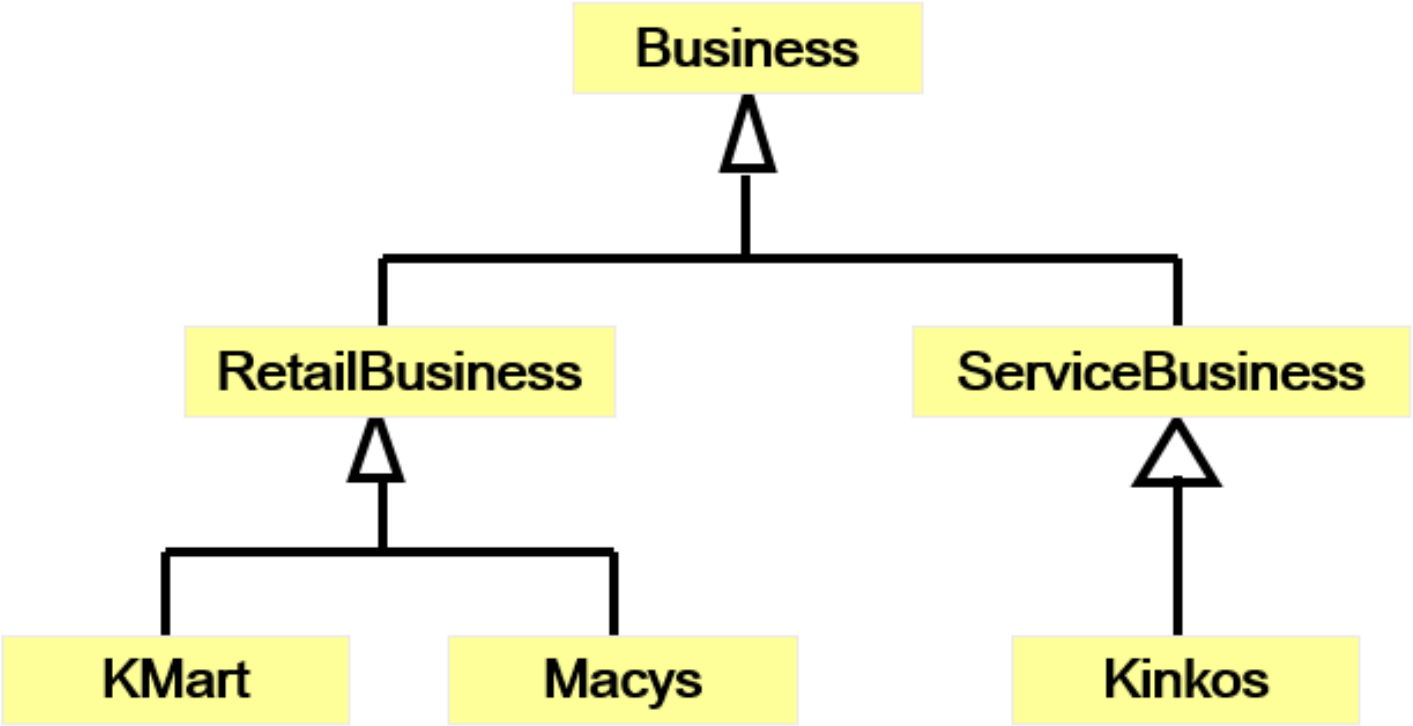
Superclass (Parent)

```
class student
{
int power;
public void setPower (int Power)
…..
}
```

Sub-class (Child)

```
class GradStud extends Student
{
int power; //shadowing variable power
//override the method setPower
Public void setPower (int Power);
int matricNo;     //Student class members
}
```

INHERITANCE : Class Hierarchies



A class hierarchy is form when a child class of one parent become a parents if another child

INHERITANCE : Indirect use of Members

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An inherited member can be referenced directly by name in the child class, as if it were declared in the child class

But even if a method or variables is not inherited by a child, it can still **be accessed indirectly** through parent methods.

Member Accessibility : Public, Private and Protected

Will be discussed in the next class….

Give one real-world example that use Inheritance Concept.

- Minimum each parent class has two child
- Draw the Class Diagram for your problem
- Introduce some attributes and method to both parent and child classes

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