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# [DES103(Y23S2)-LAB03-OVERVIEW]

## Inheritance, `Super`, Constructor chaining

### Learning Objectives

1. To learn the concept of inheritance
2. To learn how to extend a class in Java
3. To learn how a subclass inherit properties/methods from its superclass
4. To learn the super keyword and how to use it
5. To learn the constructor chaining behavior

### 3.1 SuperClass and Subclass

- **A super class** is a class that is derived by another class.
  It is also called a parent class or a base class
- **A subclass** is a class that derives from an existing class.
  It is also called a child class.

### 3.2 Inheritance Rules

- The keyword extends is used for indicating that the Cylinder class is derived from the Circle class.
- The keyword super invokes the constructor of the super class to initially set the property's value.

### 3.3 super keyword

- The constructors from a superclass are not inherited in the subclass. Thus, the only way to invoke a superclass constructor is to use super.
- The call-to-super statement must appear in the first line of the subclass constructor.
- When a constructor of a subclass is invoked without calling super class constructor, it automatically calls a default constructor of a superclass (super() is called).
- The non-private properties or methods in the super class can be accessed directly by super.method and super.property.

### 3.4 Overriding Method

- The subclass can have a method having the same name with its super class. The content of such a method can also differ from the parent class.
- We say that the subclass overrides the method of the superclass.

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## 3.5 The "final" keyword

- When it is placed in front of a class definition, it prevents a class from being extended
- When it is placed in front of a variable, it prevents a variable from being modified (it becomes a constant)
- When it is placed in front of a method, it forces the method not to be overwritten by the subclass

## Example of Inheritance:

Circle-Cylinder, the Circle is the super class of Cylinder. The Cylinder class is the subclass of Circle.

```
public class Circle {
        int xcenter;
        int ycenter;
        double radius;
        Circle( ){
    this(1.0);
        }

        Circle(int x, int y, double r){
    xcenter = x;
    ycenter = y;
    radius = r;
        }

        Circle(double r){
    this(0, 0, r);
        }

        double findArea(){
    return 3.14*radius*radius;
        }

        double findDiameter(){
           return 2*radius;
        }
}
```

```
class Cylinder extends Circle
{
        double height;

        Cylinder(){
    super( );
           height=1.0;
        }

        Cylinder(int x, int y, double r,
       double h){
    super(x, y, r);
           height=h;
        }

        Cylinder(int h ){
     height = h;
        }

        double findVolume(){
   return super.findArea()*height;
        }
}
```

http://hilite.me converts your code snippets into pretty-printed HTML format, easily embeddable into blog posts, emails, and websites.

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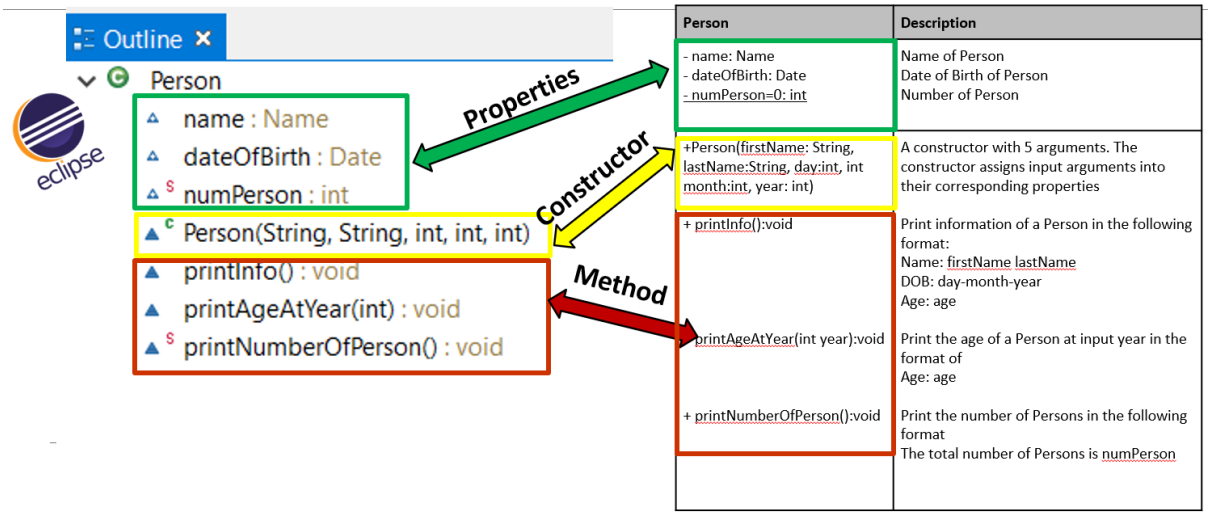
## 3.6 Unified Modeling Language (UML)

UML is a standard way to represent the class's skeleton. It is represented with a table of 3 rows: the first row: title, the second row: properties, and the third row: constructors and methods.

As shown below, Eclipse IDE has an outline panel to represent UML.




| Person | Description |
|---|---|
| - name: Name<br>- dateOfBirth: Date<br>- numPerson=0: int | Name of Person<br>Date of Birth of Person<br>Number of Person |
| +Person(firstName: String, lastName:String, day:int, int month:int, year: int) | A constructor with 5 arguments. The constructor assigns input arguments into their corresponding properties |
| + printInfo():void | Print information of a Person in the following format:<br>Name: firstName lastName<br>DOB: day-month-year<br>Age: age |
| printAgeAtYear(int year):void | Print the age of a Person at input year in the format of<br>Age: age |
| + printNumberOfPerson():void | Print the number of Persons in the following format<br>The total number of Persons is numPerson |
| | |

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# [DES103(Y23S2)-LAB03-EXERCISES]

**Students MUST adhere to the lab instructions and regulations provided below. Please consult your TA to review your completed exercises and submit them on Google Class.**

**Be noticed** that for all lab exercises, you need to define your *Java* project as the following name format:

<Student ID>_<Lab number>_<Exercise name>

If your student's ID is 6122300300, the name format of your java project should be:

6422300208_LAB03_ CompanyHierarchy

## Exercise 1: (2 points)

Project Name : <StudentID>_LAB03_ CompanyHierarchy

Instruction : Complete a class Person provided in a template using the given UML.

Remark: Students should re-uses Java classes: **Name.java**, **Date.java** from Google Classroom.

| **Person** | **Description** |
|---|---|
| name: Name<br>dateOfBirth: Date<br>numPerson=0: int | Name of Person<br>Date of Birth of Person<br>Number of Person |
| Person(firstName: String, lastName:String, day:int, month:int, year:int) | A constructor with 5 arguments. The constructor assigns input arguments into their corresponding properties |
| printInfo():void | Print information of a Person in the following format:<br>Name: *firstName lastName*<br>DOB: *day-month-year*<br>Age: *age* |
| printAgeAtYear(int year):void | Print the age of a Person at input year in the format of<br>Age: *age* |
| printNumberOfPerson():void | Print the number of Persons in the following format<br>The total number of Persons is *numPerson*. |

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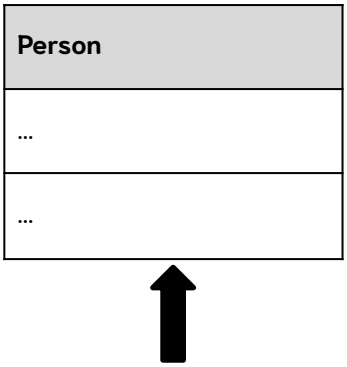
## Exercise 2: (2 points)

Project Name : <StudentID>_LAB03_ CompanyHierarchy

Instruction : Complete a class **Employee** provided in a template using the given UML.




| Employee | Description |
|---|---|
| workplace: String<br>position: String<br>salary: double | Workplace of Employee<br>Position of Employee<br>Salary of Employee |
| Employee(firstName:String, lastName:String, day:int, month:int, year:int, workplace:String, position:String, salary:double) | A constructor with 8 arguments |
| printInfo():void | Print info of Employee in the following format:<br>Name: firstName lastName<br>DOB: day-month-year<br>Age: age<br>Work Place: workplace<br>Position: position<br>Salary: salary |
| followRule(rule:String ): void | Print the input rule in the format of firstname lastname follows rule<br>Position: firstname lastname<br>Followed: rule |

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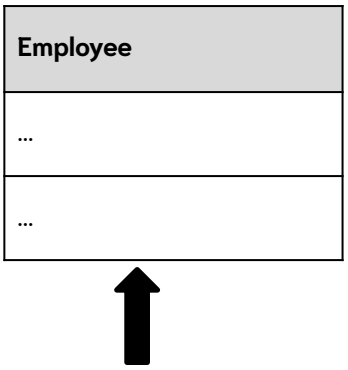
## Exercise 3: (2 points)

Project Name : <StudentID>_LAB03_ CompanyHierarchy

Instruction : Complete a class **Executive** provided in a template from the given UML.




| **Executive** | **Description** |
|---|---|
| bonus: double bonus | Bonus |
| Executive (firstName:String lastName:String, day:int, month: int, year:int, workplace:String, position:String, salary:double, bonus: double) | A constructor with 9 arguments |
| printInfo():void | Print info of an Executive in the following format<br>Name: firstName lastName<br>DOB: day-month-year<br>Age: age<br>Workplace: workplace<br>Position: position<br>Salary: salary<br>Bonus: bonus |
| announceRule(rule:String): void | Print the input rule in the format of<br>Position: firstname lastname<br>Announces rule: rule |

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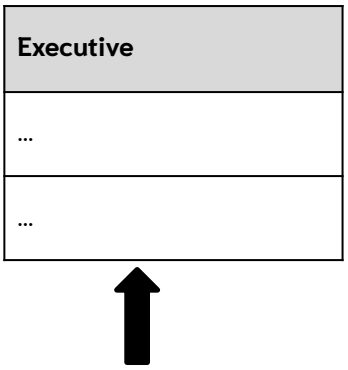
## Exercise 4: (2 points)

Project Name : <StudentID>_LAB03_ CompanyHierarchy

Instruction : Complete a class **CEO** provided in a template from the given UML.




| CEO | Description |
|---|---|
| positionVehicle: String | positionVehicle |
| CEO(firstName:String, lastName:String, day:int, month:int, year:int, workplace:String, position:String, salary:double, bonus:double, positionVehicle:String) | A constructor with 10 arguments |
| printInfo():void | Print information of an Executive in the following format:<br>Name: firstName lastName<br>DOB: day-month-year<br>Age: XX<br>Work Place: XXX<br>Position: XXX<br>Salary: XXX<br>Bonus: XXX<br>PositionVehicle: XXX |
| showVision(String vision): void | Print the input vision in the following format:<br>firstname lastname shows vision |

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## Exercise 5: (2 points)

Project Name : <StudentID>_LAB03_ CompanyHierarchy

Instruction : Complete a class TestCompanyHierarchy with a main method.

In main, write the code that completes the following task.

Note: Use the current year as an input to calculate their ages.

Hint: Student can download the skeleton class TestCompanyHierarchy in Google Classroom

a) Print out title of "Company Information". Your running output should be as below:

```
### FUTURETECH COMPANY INFORMATION ###
```

b) Print out a title of "Visitor Information" and call printInfo() of person01 and person02. Your running output should be as below:

```
>> Visitor Information
Name: Somyai Yodyium
DOB: 15-4-1987
Age: 37
-------------------------
Name: Pitak Raksa
DOB: 1-8-1980
Age: 44
-------------------------
```

c) Print out a title of "Employee Information" and call printInfo() of employee01 and employee02. Your running output should be as below:

```
>> Employee Information
Name: Maneeya Rinrom
DOB: 15-4-1987
Age: 30
Work Place: FutureTech CO.
Position: Secretary
Salary: 15000.0
-------------------------
Name: Parinya Yenjid
DOB: 5-11-1990
Age: 27
Work Place: FutureTech CO.
Position: Technician
Salary: 22000.0
-------------------------
```

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d) Print out a title of "Executive information" and call printInfo() of executive01 and executive02.

Your running output should be as below:

```
>> Executive Information
Name: Preecha Yanusit
DOB: 30-4-1977
Age: 47
Work Place: FutureTech CO.
Position: Sale Manager
Salary: 40000.0
Bonus: 80000.0
------------------------
Name: Songpol Sangar
DOB: 10-11-1972
Age: 45
Work Place: FutureTech CO.
Position: Finance Manager
Salary: 38000.0
Bonus: 76000.0
------------------------
```

e) Print out the title of "Rule Announcement" and call the method announceRule() with input String "No nap during working hours" of executive01.

Your running output should be as below:

```
>> Rule Announcement
Sale Manager:Preecha Yanusit
Announces rule: No nap during working hours
------------------------
```

f) Print out the title of "Rule Follower" and call followRule() method with input String "No nap during working hours" of employee01 and employee02.

Your running output should be as below:

```
>> Rule Follower
Secretary:Maneeya Rinrom
Followed: No nap during work hours
Technician:Parinya Yenjid
Followed: No nap during work hours
------------------------
```

g) Print out the title of “CEO Information” and call printInfo() of ceo0.

Your running output should be as below:

```
>> CEO Information
Name: Sipol Tongyai
DOB: 19-9-1956
Age: 61
Work Place: FutureTech CO.
Position: President
Salary: 150000.0
Bonus: 500000.0
position Vehicle: BMW A5
------------------------
```

h) Print out the title of “CEO Vision” and call showVision() of ceo01 with input String “becoming ISO standard”. Your running output should be as below:

```
>> CEO Vision
Sipol Tongyai shows becoming ISO standard
------------------------
```

i) Print out the title of “Number of Person” and call the **static** method printNumberOfPerson from the Person class. Your running output should be as below:

```
>> Number of Person
The total number of Persons is 7 persons.
```

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Student can copy the class skeleton TestCompanyHierarchy as follows:

```
// TestCompanyHierarchy.java

public class TestCompanyHierarchy {
        public static void main(String[] args) {

                // a) print out title of “company information”.
                // >> student can write your code here

                // b) print out a title of “Visitor  Information” and call printInfo() of person01 and person02
                // >> student can write your code here //print out title
                // construct Person objects
                // >> student can write your code here
                // >> student can write your code here
                // print out information
                // >> student can write your code here
                System.out.println("-------------------------");
                // >> student can write your code here
                System.out.println("-------------------------\n");


                // c) print out a title of “Employee Information” and call printInfo() of employee01 and employee02.
                // >> student can write your code here //print out title
                // construct Employee objects
                // >> student can write your code here
                // >> student can write your code here
                // print out employee information
                // >> student can write your code here
                System.out.println("-------------------------");
                // >> student can write your code here
                System.out.println("-------------------------\n");

                // d) print out a title of “Executive information” and call printInfo() of executive01 and executive02.
                // >> student can write your code here //print out title
                // construct Executive objects
                // >> student can write your code here
                // >> student can write your code here
                // print out employee information
                // >> student can write your code here
                System.out.println("-------------------------");
                // >> student can write your code here
                System.out.println("-------------------------\n");

                // e) print out title of "Rule Announcement" and
                // call the method announceRule() with input String “take no nap during working hours” of executive01.
                // >> student can write your code here //print out title
                // >> student can write your code here
                System.out.println("-------------------------\n");

                // f) print out title of "Rule Follower" and
                // call followRule() method with input String “No nap during working hours” of employee01 and employee02.
                // >> student can write your code here //print out title
                // >> student can write your code here
                // >> student can write your code here
                System.out.println("-------------------------\n");

                // g) print out title of “CEO Information” and call printInfo() of ceo01.
                // >> student can write your code here //print out title
                // Construct President
                // >> student can write your code here
                // print out employee information
                // >> student can write your code here
                System.out.println("-------------------------\n");

                // h) print out title of “CEO Vision” and call showVision()
                // >> student can write your code here //print out title
                // >> student can write your code here
                System.out.println("-------------------------\n");

                // i) print out title of “Number of Person” and
                // call the static method printNumberOfPerson from the Person class.
                // >> student can write your code here //print out title
                Person.printNumberOfPerson();
        }
}
```

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## Running output should be as below:

```
### FUTURETECH COMPANY INFORMATION ###
>> Visitor Information
Name: Somyai Yodyium
DOB: 15-4-1987
Age: 30
-------------------------
Name: Pitak Raksa
DOB: 1-8-1980
Age: 37
-------------------------

>> Employee Information
Name: Maneeya Rinrom
DOB: 15-4-1987
Age: 30
Work Place: FutureTech CO.
Position: Secretary
Salary: 15000.0
-------------------------
Name: Parinya Yenjid
DOB: 5-11-1990
Age: 27
Work Place: FutureTech CO.
Position: Technician
Salary: 22000.0
-------------------------

>> Executive Information
Name: Preecha Yanusit
DOB: 30-4-1977
Age: 47
Work Place: FutureTech CO.
Position: Sale Manager
Salary: 40000.0
Bonus: 80000.0
-------------------------
Name: Songpol Sangar
DOB: 10-11-1972
Age: 52
Work Place: FutureTech CO.
Position: Finance Manager
Salary: 38000.0
Bonus: 76000.0
-------------------------

>> Rule Announcement
Sale Manager:Preecha Yanusit
Announces rule: No nap during working hours
-------------------------

>> Rule Follower
Secretary:Maneeya Rinrom
Followed: No nap during work hours
Technician:Parinya Yenjid
Followed: No nap during work hours
-------------------------

>> CEO Information
Name: Sipol Tongyai
DOB: 19-9-1956
Age: 61
Work Place: FutureTech CO.
Position: President
Salary: 150000.0
Bonus: 500000.0
position Vehicle: BMW A5
-------------------------

>> CEO Vision
Sipol Tongyai shows becoming ISO standard
-------------------------

>> Number of Person
The total number of Persons is 7 persons.
```