Inheritance

Fundamentals to programming I

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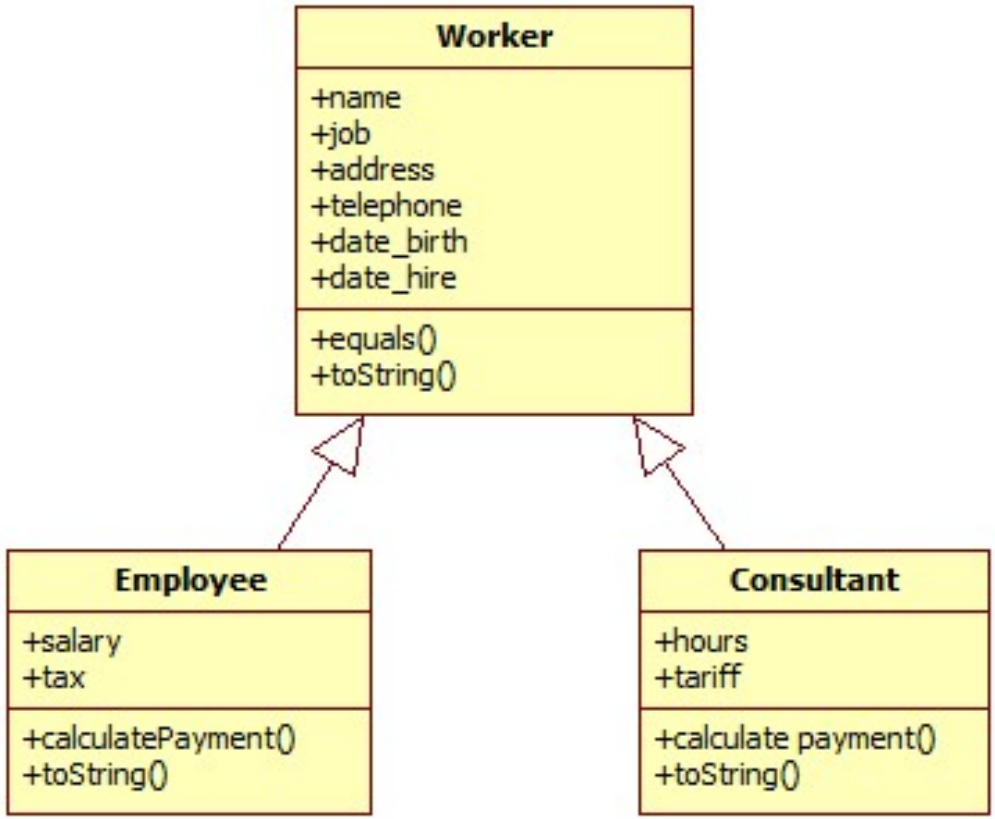
Content

Introducction

- The mechanism known as inheritance allows reusing classes: A new class is created that extends the functionality of an existing class without having to rewrite the code associated with it.

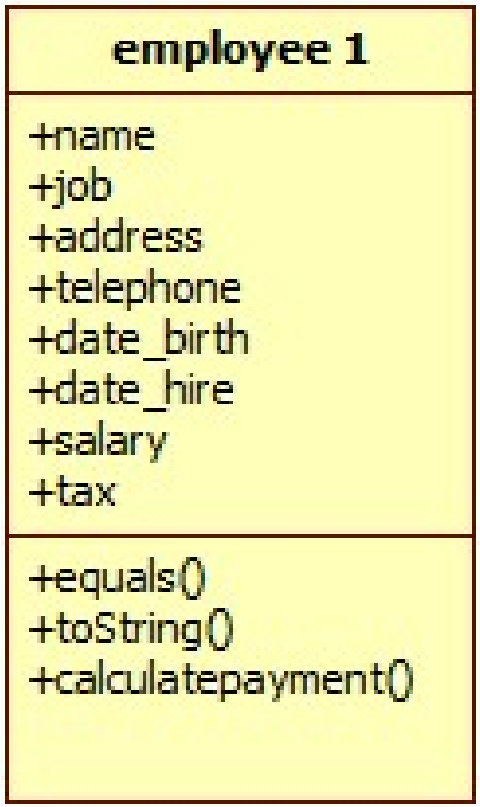
Inheritance uml diagram

the employee and constructor classes, in addition to the attributes and operations they define, inherit all their attributes and operations from the worker.



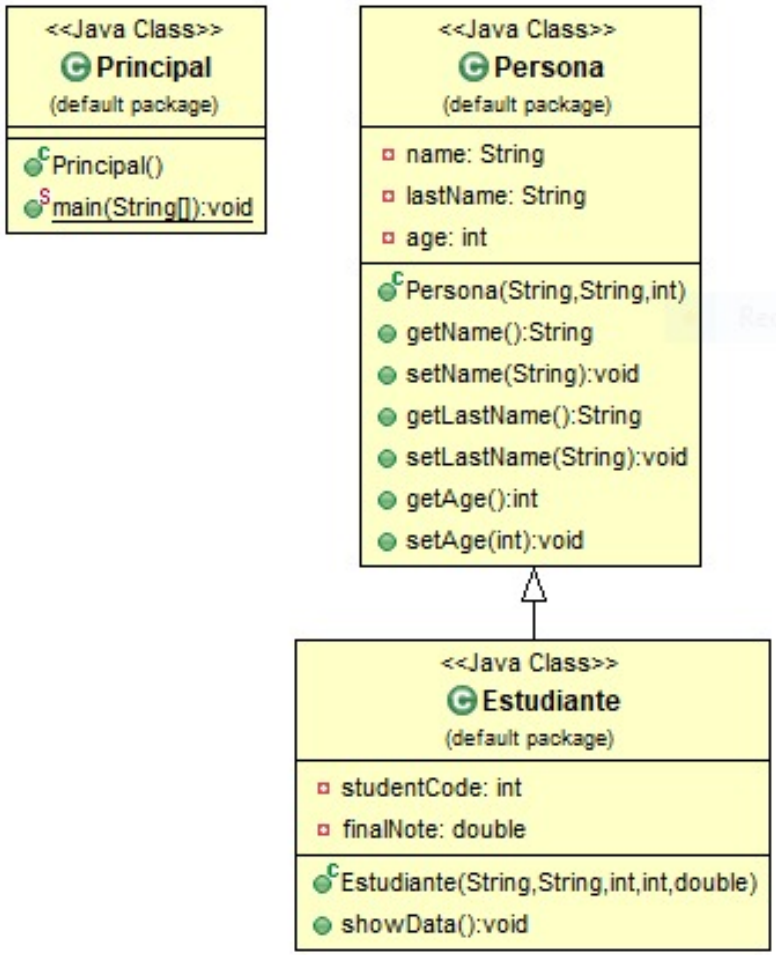
Employee uml diagram

A particular employee will have, in addition to his or her attributes and operations as an employee, all the attributes corresponding to the worker superclass.



UML Basic Example 1

- https://youtu.be/4gdhl-iRZZg



Basic Examples 1- class Person (Part 1)

Listing 1: Persona.java

```
public class Persona {
  private String name;
  private String lastName;
  private int age;

  public Persona(String name, String lastName, int age) {
    this.name = name;
    this.lastName = lastName;
    this.age = age;
  }
  public String getName() {
    return name;
  }
  public void setName(String name) {
    this.name = name;
  }
```

Basic Examples 1 - class Person (Part 2)

Listing 2: Persona.java

```
  public String getLastName() {
    return lastName;
  }
  public void setLastName(String lastName) {
    this.lastName = lastName;
  }
  public int getAge() {
    return age;
  }
  public void setAge(int age) {
    this.age = age;
  }
}
```

Basic Examples 1 - class Student

Listing 3: Estudiante.java

```
public class Estudiante extends Persona{
  private int studentCode;
  private double finalNote;
  public Estudiante (String name, String lastName, int
      age, int studentCode, double finalNote) {
    super(name,lastName,age);
    this.studentCode=studentCode;
    this.finalNote=finalNote;
  }
  public void showData() {
    System.out.println("Name: " + getName() + "\nLastname
        : " + getLastName() +
    "\nAge: " + getAge() + "\nStudent Code: " +
        studentCode + "\nFinal Note: " + finalNote);
  }
}
```

Basic Examples 1 - class Principal

Listing 4: Principal.java

```
public class Principal {
public static void main(String []args) {
  Estudiante student = new Estudiante("Glenny", "Choque",
      18, 123, 18.3);
  student.showData();
}
}
```

BAsic Example 1- Program Run

```
1
2  public class Principal {
3  public static void main(String []args) {
4      Estudiante student = new Estudiante("Glenny", "Choque", 18, 123, 18.3);
5      student.showData();
6  }
7  }
8
```

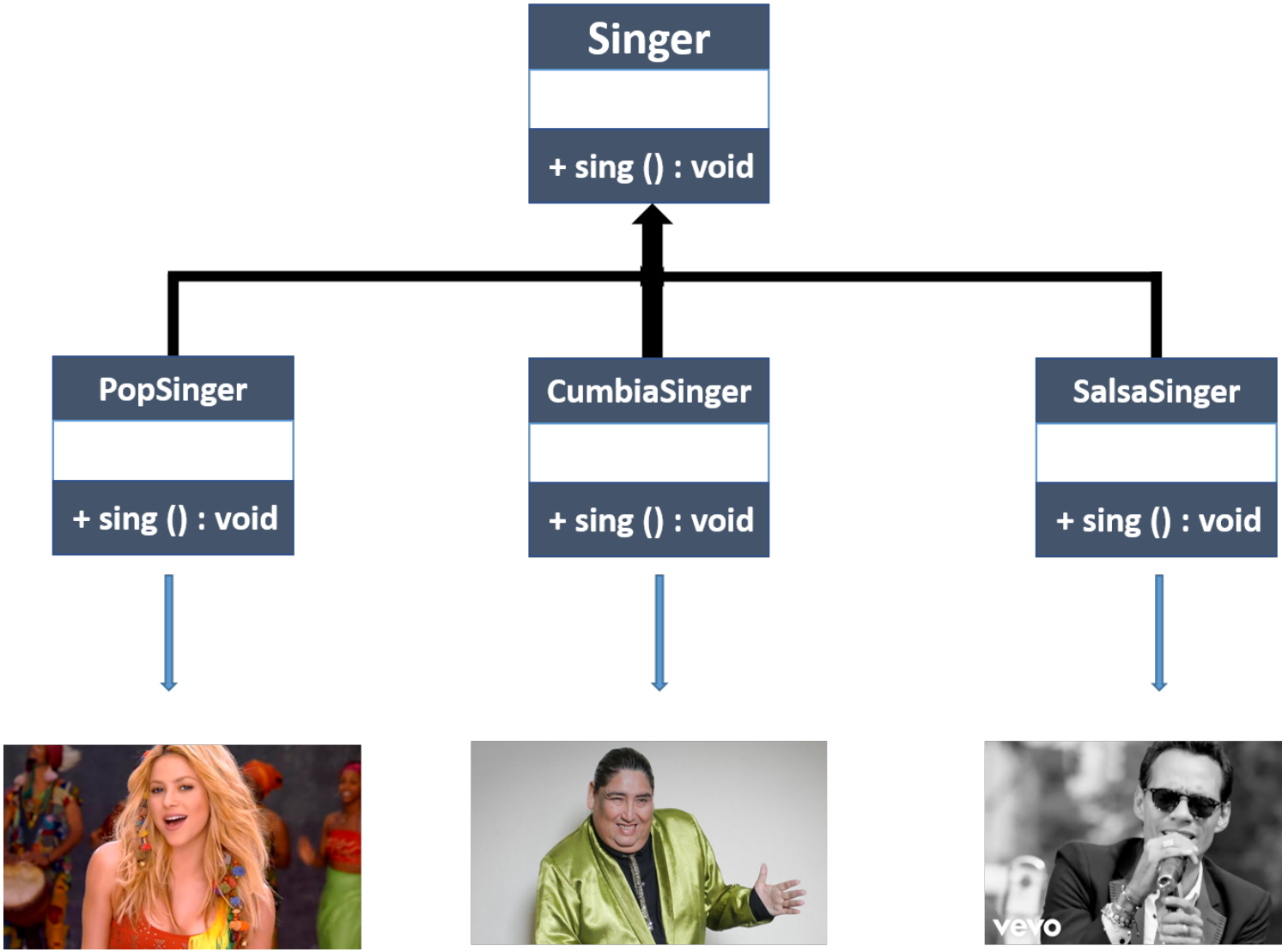
Console

```
<terminated> Principal [Java Application] C:\Program Files\Java\jre1.8.0_251\bin\javaw.exe (3 ago. 2020 15:2
Name: Glenny
Lastname: Choque
Age: 18
Student Code: 123
Final Note: 18.3
```

Method override

- A subclass inherits all the methods of its superclass that are accessible to that subclass unless the subclass overwrites the methods.
- A subclass overwrites a method of its superclass when it defines a method with the same characteristics (name, number, and type of arguments) as the method of the superclass.
- Subclasses use method overwriting most of the time to add or modify the functionality of the parent class's inherited method.

Basic Example 2 - UML Diagram Representation



Basic Examples 2- class Singer

Listing 5: Singer.java

```
public class Singer {

   public void sing () {
      System.out.println("i'm singing");
   }
}
```

Basic Examples 2- class PopSinger

Listing 6: PopSinger.java

```
public class PopSinger extends Singer {

   @Override
   public void sing () {
      System.out.println("i'm singing pop");
   }
}
```

Basic Examples 2- class SalsaSinger

Listing 7: SalsaSinger.java

```
public class SalsaSinger extends Singer {
   @Override
   public void sing () {
      System.out.println("i'm singing salsa");
   }
}
```

Basic Examples 2- class CumbiaSinger

Listing 8: CumbiaSinger.java

```
public class CumbiaSinger extends Singer {
   @Override
   public void sing () {
      System.out.println("i'm singing cumbia");
   }
}
```

Basic Examples 2- class CumbiaSinger

Listing 9: Main.java

```
public class Main {

  public static void main(String[] args) {
    Singer singer = new Singer ();
    PopSinger popSinger = new PopSinger ();
    SalsaSinger salsaSinger = new SalsaSinger ();
    CumbiaSinger cumbiaSinger = new CumbiaSinger ();

    singer.sing();
    popSinger.sing();
    salsaSinger.sing();
    cumbiaSinger.sing();
  }
}
```

Basic Example 2 - Program Rum

```java
public class Main {

    public static void main(String[] args) {
        Singer singer = new Singer ();
        PopSinger popSinger = new PopSinger ();
        SalsaSinger salsaSinger = new SalsaSinger ();
        CumbiaSinger cumbiaSinger = new CumbiaSinger ();

        singer.sing();
        popSinger.sing();
        salsaSinger.sing();
        cumbiaSinger.sing();
    }
}
```

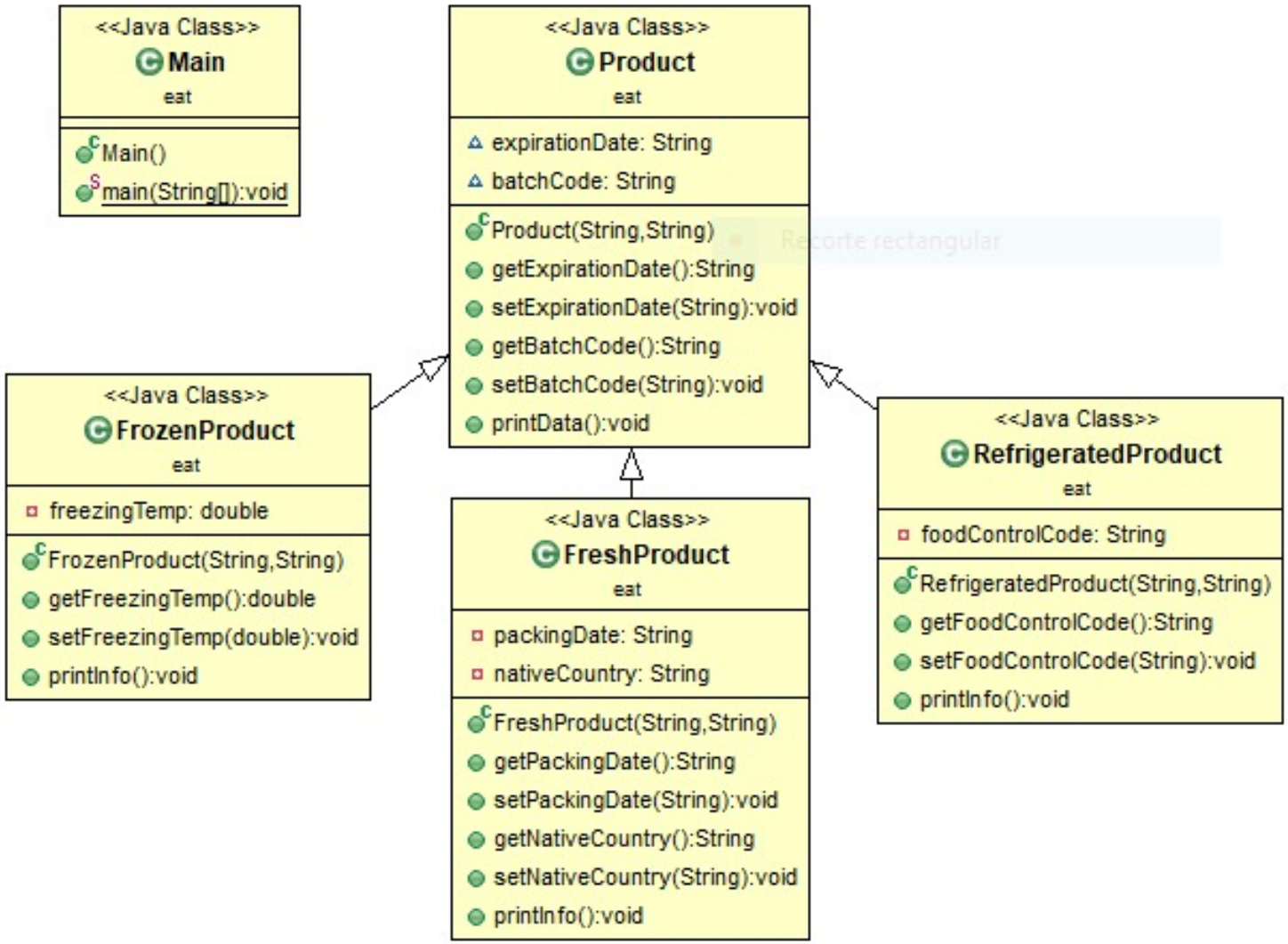
Problems Javadoc Declaration Console

<terminated> Main (8) [Java Application] C:\Program Files\Java\jre1.8.0_261\bin\javaw.exe

```
i'm singing
i'm singing pop
i'm singing salsa
i'm singing cumbia
```

Advanced Example 1 - UML Diagram Representation

- https://youtu.be/sGNhcWFLOJ8



Advance Example 1- class product (Part 1)

Listing 10: Product.java

```
package eat;
public class Product {
  String expirationDate, batchCode;

  public Product(String expirationDate, String batchCode)
      {
    this.expirationDate = expirationDate;
    this.batchCode = batchCode;
  }
  public String getExpirationDate() {
    return expirationDate;
  }
  public void setExpirationDate(String expirationDate) {
```

Advance Example 1- class product (Part 2)

Listing 11: Product.java

```
    this.expirationDate = expirationDate;
  }
  public String getBatchCode() {
    return batchCode;
  }
  public void setBatchCode(String batchCode) {
    this.batchCode = batchCode;
  }
  public void printData() {
    System.out.println("Expiration Date: " +
        getExpirationDate()+ "\nBatch Code: " +
        getBatchCode());
  }
}
```

Advance Example 1- class FrozenProduct

Listing 12: FrozenProduct.java

```
package eat;
public class FrozenProduct extends Product{
  private double freezingTemp;
  public FrozenProduct(String expirationDate, String
      batchCode){
        super(expirationDate, batchCode);
        freezingTemp = 0;                    }
  public double getFreezingTemp() {
    return freezingTemp;                     }
  public void setFreezingTemp(double Temp) {
    freezingTemp = Temp;                     }
  public void printInfo(){
        printData();
        System.out.println("Freezing temperature: " +
            getFreezingTemp() + "\n");
    }
```

Advance Example 1- class FreshProduct (Part 1)

Listing 13: FreshProduct.java

```
package eat;
public class FreshProduct extends Product {
  private String packingDate, nativeCountry;
  public FreshProduct (String expirationDate, String
      batchCode){
        super(expirationDate, batchCode);
        packingDate = "Desconocido";
        nativeCountry = "Desconocido";
    }
  public String getPackingDate() {
    return packingDate;
  }
  public void setPackingDate(String Date) {
```

Advance Example 1- class FreshProduct (Part 2)

Listing 14: FreshProduct.java

```
    packingDate = Date;
  }
  public String getNativeCountry() {
    return nativeCountry;
  }
  public void setNativeCountry(String Country) {
    nativeCountry = Country;
  }
  public void printInfo(){
        printData();
        System.out.println("packing Date: " +
            getPackingDate() + "\nNative Country" +
            getNativeCountry()+"\n");
    }
}
```

Advance Example 1- class RefrigeratedProduct

Listing 15: RefrigeratedProduct.java

```
package eat;
public class RefrigeratedProduct extends Product{
  private String foodControlCode;
  public RefrigeratedProduct(String expirationDate,
      String batchCode){
         super(expirationDate, batchCode);
         foodControlCode = "Desconocido";     }
  public String getFoodControlCode() {
    return foodControlCode;                   }
  public void setFoodControlCode(String Code) {
    foodControlCode = Code;                   }
  public void printInfo(){
         printData();
         System.out.println("food Control Code: " +
            getFoodControlCode() + "\n" );
    }
```

Advance Example 1- class Main (Part 1)

Listing 16: Main.java

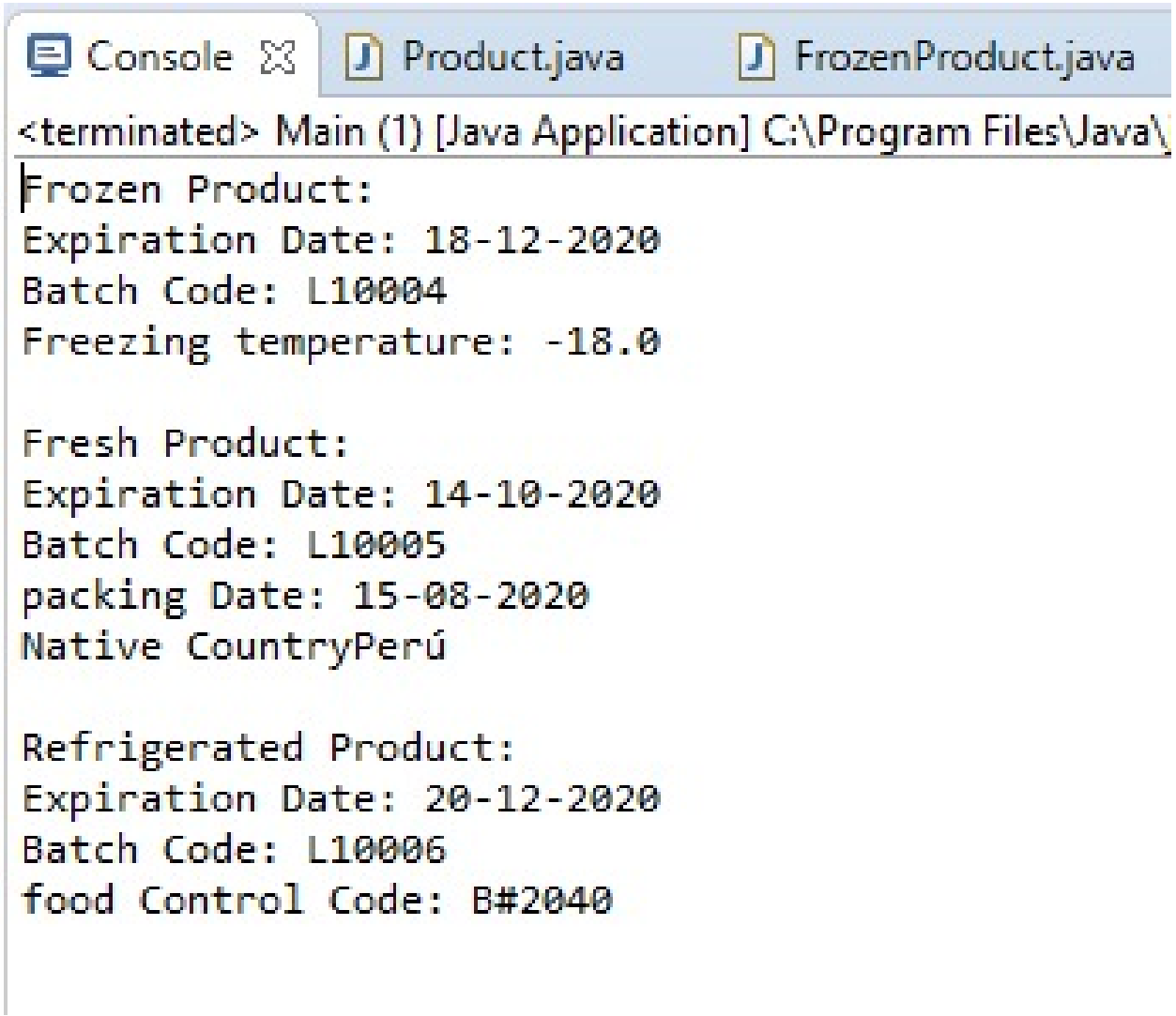
```
public class Main {
public static void main (String[]args) {
  FrozenProduct nuggets = new FrozenProduct ("18-12-2020"
      , "L10004");
  FreshProduct lettuce = new FreshProduct ("14-10-2020",
      "L10005");
  RefrigeratedProduct juice = new RefrigeratedProduct ("
      20-12-2020", "L10006");
  nuggets.setFreezingTemp(-18);
  lettuce.setPackingDate("15-08-2020");
  lettuce.setNativeCountry("Peru");
  juice.setFoodControlCode("B#2040");
  System.out.println("Frozen Product: ");
  nuggets.printInfo();label
```

Advance Example 1- class Main (Part 2)

Listing 17: Main.java

```
    System.out.println("Fresh Product: ");
    lettuce.printInfo();
    System.out.println("Refrigerated Product: ");
    juice.printInfo();
}
}
```

Advance Example 1- Program Run

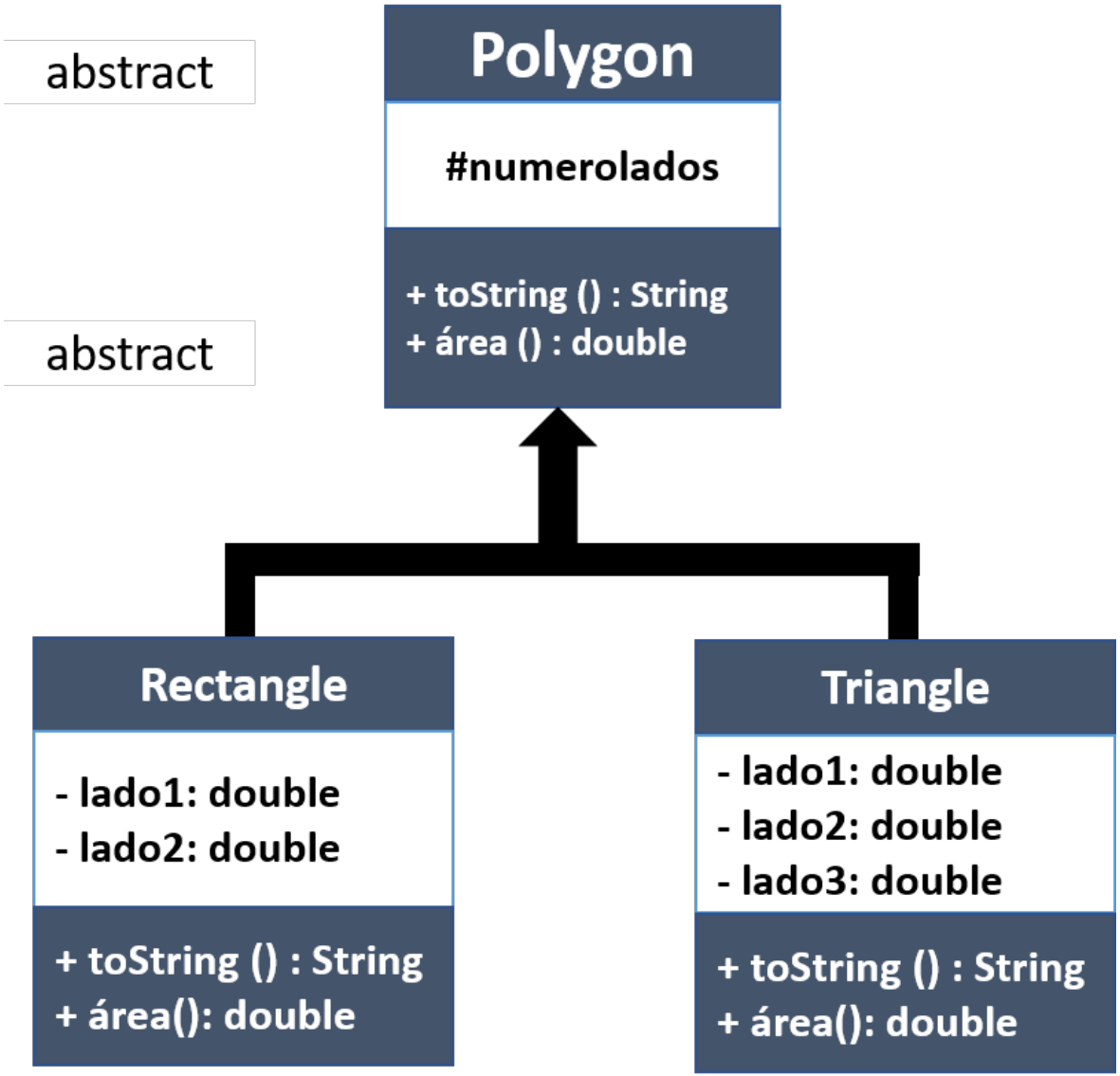


Advanced Example 2 -statement

Make a program to calculate the area of Polygons (Triangles and Rectangles) the program should be able to store in an N array triangles and rectangles, and at the end show the area and data of each one. To do this, you will have the following:

- A super class called Polygon.
- A sub class called Rectangle.
- A sub class called Triangle.

Advanced Example 2 - UML Diagram Representation



Advance Example 2- class Polygon (Part 1)

Listing 18: Polygon.java

```
public abstract class Polygon {
  protected int numSides;

  public Polygon(int numsides) {
    this.numSides = numsides;
  }
  public int getNumsides() {
    return numSides;
  }

  public void setNumsides(int numsides) {
    this.numSides = numsides;
```

Advance Example 2- class Polygon (part 2)

Listing 19: Polygon.java

```
    }

    public String toString() {
      return "Number Of sides: " + numSides ;
    }
    //declaramos el metodo area como abstracto
    public abstract double area();
}
```

Advance Example 2- class Rectangle (Part 1)

Listing 20: Rectangle.java

```
public class Rectangle extends Polygon {

  private double side1;
  private double side2;
  public Rectangle(double side1, double side2) {
    super(2);
    this.side1 = side1;
    this.side2 = side2;
  }
  public double getSide1() {
    return side1;
  }
  public void setSide1(double side1) {
    this.side1 = side1;
  }label
```

Advance Example 2- class Rectangle (Part 2)

Listing 21: Rectangle.java

```
public double getSide2() {
  return side2;
}
public void setSide2(double side2) {
  this.side2 = side2;
}
@Override
public String toString() {
  return "Rectangle: \n" + super.toString() + "\nside1=
      " + side1 + "\nside2= " + side2;
}
@Override
public double area() {
  return side1 * side2;
}
```

Advance Example 2- class Triangle(Part 1)

Listing 22: Triangle.java

```
public class Triangle extends Polygon{
  private double side1;
  private double side2;
  private double side3;

  public Triangle( double side1, double side2, double
      side3) {
    super(3);
    this.side1 = side1;
    this.side2 = side2;
    this.side3 = side3;
  }

  public double getSide1() {
    return side1;
  }label
```

Advance Example 2- class Triangle(Part 2)

Listing 23: Triangle.java

```
  public void setSide1(double side1) {
    this.side1 = side1;
  }

  public double getSide2() {
    return side2;
  }

  public void setSide2(double side2) {
    this.side2 = side2;
  }

  public double getSide3() {
    return side3;
  }label
```

Advance Example 2- class Triangle(Part 3)

Listing 24: Triangle.java

```
  public void setSide3(double side3) {
    this.side3 = side3;
  }

  @Override
  public String toString() {
    return "Triangle: \n" + super.toString() + " \nside1=
        " + side1 + "\nside2=" + side2 + "\nside3=" +
        side3;
  }
  @Override
```

Advance Example 2- class Triangle(Part 4)

Listing 25: Triangle.java

```
  public double area() {
    //formula de Heron
    double p = (side1+side2+side3)/2;
    return Math.sqrt (p*(p-side1)*(p-side2)*(p-side3));
  }
}
```

Advance Example 2- class Main(Part 1)

Listing 26: Main.java

```
import java.lang.reflect.Array;
import java.util.ArrayList;
import java.util.Scanner;

public class Main {
   static Scanner sc = new Scanner (System.in);
   static ArrayList<Polygon> polygon = new ArrayList <
      Polygon>();
```

Advance Example 2- class Main(Part 2)

Listing 27: Main.java

```
public static void main(String[] args) {

//llenarPoligono
  fillPolygon();
//mostrar datos del area de cada poligono
  showResults();
}
```

Advance Example 2- class Main(Part 3)

Listing 28: Main.java

```
public static void fillPolygon() {
  char answer;
  int option;
do {
    do{
      System.out.println("Type in your desired polygon"
          );
      System.out.println("1. Triangle");
      System.out.println("2. Rectangle");
      System.out.print("option: ");
      option = sc.nextInt();
    }while (option<1 || option>2);
```

Advance Example 2- class Main(Part 4)

Listing 29: Main.java

```
    switch (option) {
    case 1: fillTriangle();//llenar un triangulo
        break;
    case 2: fillRectangle();//llenar un rectangulo
        break;
}
System.out.println("\nDo you want to introduce
    another polygon (y/n)?");
    answer = sc.next().charAt(0);
    System.out.println("");
}while (answer=='y' || answer =='Y');
```

Advance Example 2- class Main(Part 5)

Listing 30: Main.java

```
  }

  public static void  fillTriangle() {
    //solicitar lados
    double side1, side2, side3;
    System.out.print("\nenter the side 1 of the triangle:
        ");
    side1= sc.nextInt();
    System.out.print("\nenter the side 2 of the triangle:
        ");
    side2= sc.nextInt();
    System.out.print("\nenter the side 2 of the triangle:
        ");
    side3= sc.nextInt();
```

Advance Example 2- class Main(Part 6)

Listing 31: Main.java

```
    Triangle triangle = new Triangle (side1,side2, side3)
        ;
    //guardamos un triangulo dentro de nuestro arreglo de
        poligonos
    polygon.add(triangle);
  }

  public static void fillRectangle() {
    double side1, side2;
    System.out.print("\nenter the side 1 of the Rectangle
        : ");
    side1= sc.nextInt();
    System.out.print("\nenter the side 2 of the Rectangle
        : ");
```

Advance Example 2- class Main(Part 7)

Listing 32: Main.java

```
    side2= sc.nextInt();

    Rectangle rectangle = new Rectangle (side1,  side2);
    //guardamos un rectangulo dentro de nuestro arreglo
        de poligonos
    polygon.add(rectangle);
  }
  public static void  showResults() {
    //recorriendo el arreglo de poligonos
    for (Polygon poly: polygon ) {
      System.out.println(poly.toString());
      System.out.println(("The area is: " + poly.area()))
          ;
```

Advance Example 2- class Main(Part 7)

Listing 33: Main.java

```
        System.out.println("");
    }
  }
}
```

Advance Example 2- Program Run

```
Type in your desired polygon
1. Triangle
2. Rectangle
option: 2

enter the side 1 of the Rectangle: 5

enter the side 2 of the Rectangle: 7

Do you want to introduce another polygon (y/n)?
y

Type in your desired polygon
1. Triangle
2. Rectangle
option: 1

enter the side 1 of the triangle: 5

enter the side 2 of the triangle: 6

enter the side 2 of the triangle: 7

Do you want to introduce another polygon (y/n)?
n

Rectangle:
Number Of sides: 2
side1= 5.0
side2= 7.0
The area is: 35.0

Triangle:
Number Of sides: 3
side1=5.0
side2=6.0
side3=7.0
The area is: 14.696938456699069
```

References - Web pages

- https://elvex.ugr.es/decsai/java/pdf/9B-herencia.pdf
- https://elvex.ugr.es/decsai/java/
- https://aprenderaprogramar.com/foros/index.php?topic=2376.0
- https://rua.ua.es/dspace/bitstream/10045/15995/1/POO-3-Herencia-10-11.pdf

Thanks!...