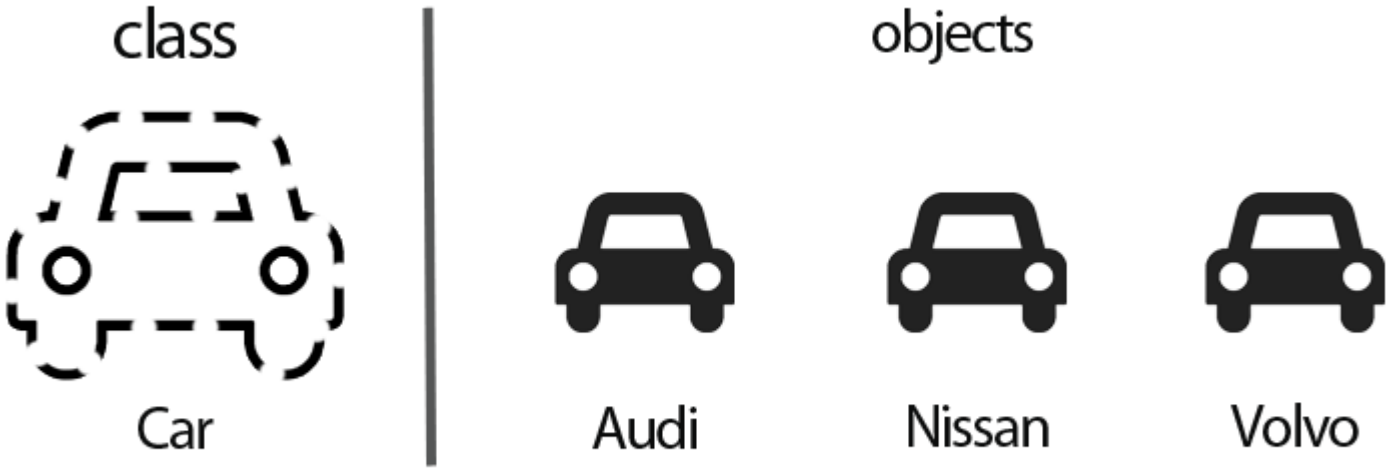
Java Training
OOP

Agenda

- Classes and Objects
- Constructors
- Enum
- Encapsulation, Inheritance, Polymorphism
- Static methods
- JavaBeans Fundamentals

Classes and Objects

- **Object** – a specified entity in our program
- **Class** – a template or abstraction of our program entities , like a blueprint



https://javatutorial.net/java-oop

Entity Class

```
public class Car {
    private double fuel;
    private double currentSpeed;

   public Car() {}

   public Car(double fuel, double currentSpeed) {
        this.currentSpeed = currentSpeed;
        this.fuel = fuel;
    }

    public Car (Car car) {
        this.fuel = car.getFuel();
        this.currentSpeed = car.getCurrentSpeed;
    }

    public double getFuel() {
        return fuel;
    }

    public void setFuel(double fuel) {
        this.fuel = fuel;
    }
...
}
```

Objects

```
public static void main(String[] args) {
    Car sportCar = new Car(50, 250);
    Car van = new Car(100, 120);
}
```

https://csawesome.runestone.academy/runestone/books/published/csawesome/Unit2-Using-Objects/topic-2-1-objects-intro-turtles.html

Inheritance

Library user

Reader

Librarian

Student

Teacher

Inheritance

- Inheritance is the mechanism by which an object acquires the some/all properties of another object.
- It supports the concept of hierarchical classification.

```
public class Van extends Car {
   private double loadCapacity;

   public Van(double fuel, double currentSpeed, ColorEnum color, double loadCapacity) {
      super(fuel, currentSpeed, color);
      this.loadCapacity = loadCapacity;
   }

   public double getLoadCapacity() {
      return loadCapacity;
   }

   public void setLoadCapacity(double loadCapacity) {
       this.loadCapacity = loadCapacity;
   }
}
```

Immutable Objects

- Object which state can't be modified after the creation

```
public final class ImmutableCar {
   private final Car car;

   public ImmutableCar(Car car) {
      this.car = car;
   }

   public Car setCar(Car car) {
      return new ImmutableCar(car);
   }
}
```

Old style enum

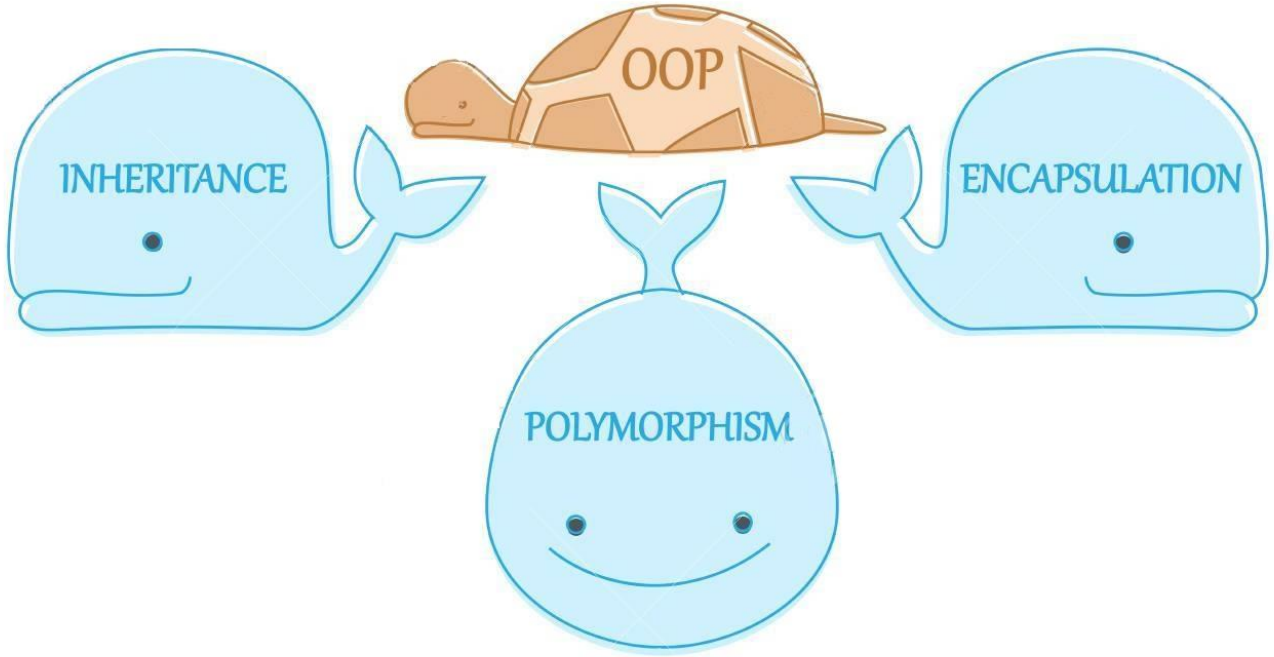
```
public class Season {
    public static final Season SPRING = new Season("SPRING");
    public static final Season SUMMER = new Season("SUMMER ");
    public static final Season AUTUMN = new Season("AUTUMN ");
    public static final Season WINTER = new Season("WINTER ");

    private String seasonName;

    public Season(String seasonName) {
        this.seasonName = seasonName;
    }
}
```

Enum

```
public enum Season {
    SPRING,
    SUMMER,
    AUTUMN,
    WINTER
}
```

https://proft.me/2015/03/29/primer-raboty-s-perechisleniyami-enum-v-java/

Encapsulation, Inheritance, Polymorphism



https://www.123rf.com/photo_56461675_stock-vector-object-oriented-programming-concept-representation-of-world-turtle-with-oop-on-three-whales-inherita.html

Encapsulation

private

Package private

Protected

Public

Encapsulation

- Binding the data with the code that manipulates it.
- It keeps the data and the code safe from external interference

```
public class Word {
    private char[] letters;

    public Word(char[] letters) {
        this.letters = letters;
    }

    public Word(String letters) {
        this.letters = letters.toCharArray();
    }

    public void setLetters(char[] letters) {
        this.letters = letters;
    }

    public void setLetters(String letters) {
        this.letters = letters.toCharArray();
    }
}
```

Polymorphism

- Polymorphism means to process objects differently based on their data type.
- In other words it means, one method with multiple implementation, for a certain class of action. And which implementation to be used is decided at runtime depending upon the situation (i.e., data type of the object)

Polymorphism: Overriding

```
public interface Calculator {
    double calculate(double firstNumber, double secondNumber);
}
```

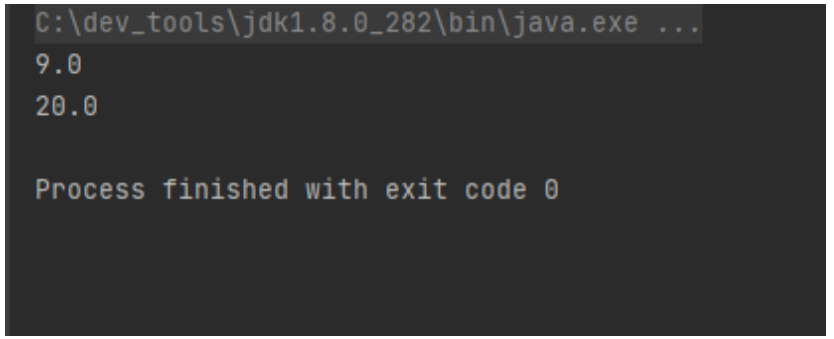
```
public class MultiplicationCalculator implements Calculator{
    @Override
    public double calculate(double firstNumber, double secondNumber) {
        return firstNumber * secondNumber;
    }
}
```

```
public class SumCalculator implements Calculator {
    @Override
    public double calculate(double firstNumber, double secondNumber) {
        return firstNumber + secondNumber;
    }
}
```

Polymorphism: Overriding

```
public class Service {
    private Calculator calculator;

    public Service(Calculator calculator) {
        this.calculator = calculator;
    }

    public double calculate(double firstNumber, double secondNumber) {
        return calculator.calculate(firstNumber, secondNumber);
    }
}
```

```
public static void main(String[] args) {
    Calculator multiplicationCalculator = new MultiplicationCalculator();
    Calculator sumCalculator = new SumCalculator();
    Service sumService = new Service(multiplicationCalculator);
    Service multiplicationService = new Service(multiplicationCalculator);

    double firstNumber = 4;
    double secondNumber = 5;
    System.out.println(sumService.calculate(firstNumber, secondNumber));
    System.out.println(multiplicationService.calculate(firstNumber, secondNumber));
}
```



Overloading

```
public class Car {
    private double fuel;
    private double currentSpeed;
    private Color color;

    public void refuel(double fuel) {
        this.fuel += fuel;
    }

    public void refuel() {
        this.fuel += 50;
    }
```

```
public static void main(String[] args) {
    Car car = new Car(100, 100, Color.BLUE);
    System.out.println("Fuel: - " + car.getFuel());

    car.refuel();
    System.out.println("Fuel: - " + car.getFuel());

    car.refuel(10);
    System.out.println("Fuel: - " + car.getFuel());
}
```

```
C:\dev_tools\jdk1.8.0_282\bin\java.exe ...
Fuel: - 100.0
Fuel: - 150.0
Fuel: - 160.0

Process finished with exit code 0
```

Static methods

- Method is attached to the class itself not to specific object
- There is no *this* and *super* link
- Early binding
- Can’t interact with non-static blocks
- Can’t be properly overriden

Static methods

```
public class CarService {
    private static final double FUEL_PER_FILLING = 50;

   public static void fillUpCar(Car car) {
        car.setFuel(car.getFuel + FUEL_PER_FILLING);
    }
}
```

```
public static void main(String[] args) {
    Car sportCar = new Car(150, 100);
    CarService.fillUpCar(sportCar);
}
```

Static initialization blocks

Used to initialize static resources

```
public class StaticClass {
    private static final String CONSTANT_VALUE;
    private static Integer counter;

    static {
        CONSTANT_VALUE = "Initialized in the static block";
        counter = 0;
    }
}
```

Class Object

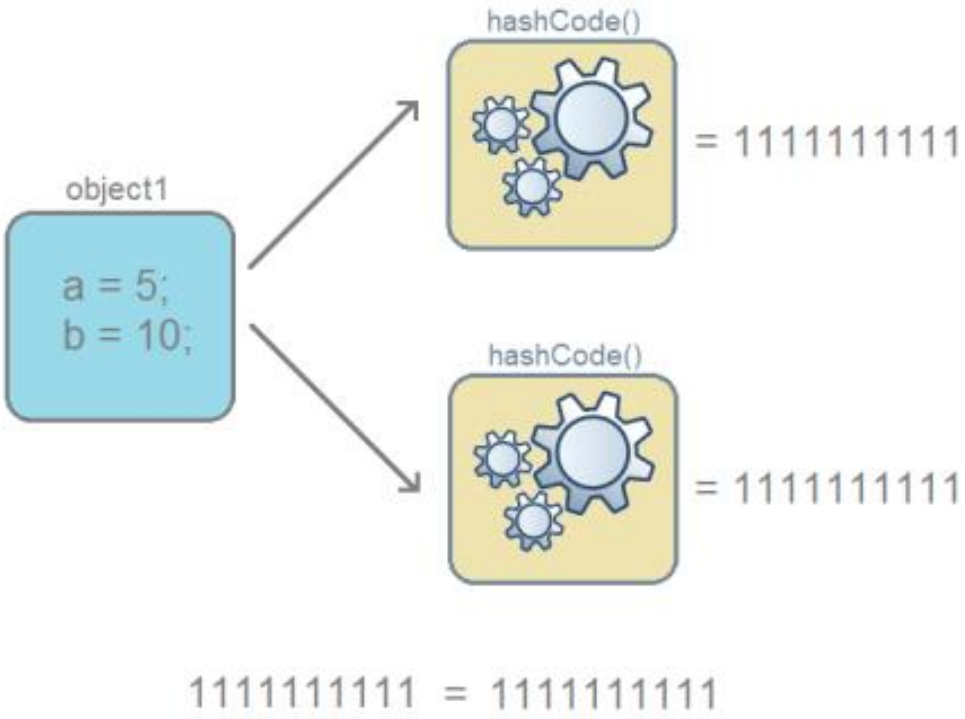
```
public class Object {
    public Object() {
    }

    private static native void registerNatives();

    public final native Class<?> getClass();

    public native int hashCode();

    public boolean equals(Object var1) {
        return this == var1;
    }

    protected native Object clone() throws CloneNotSupportedException;

    public String toString() {
        return this.getClass().getName() + "@" + Integer.toHexString(this.hashCode());
    }

    ...
```

Equals + Hashcode

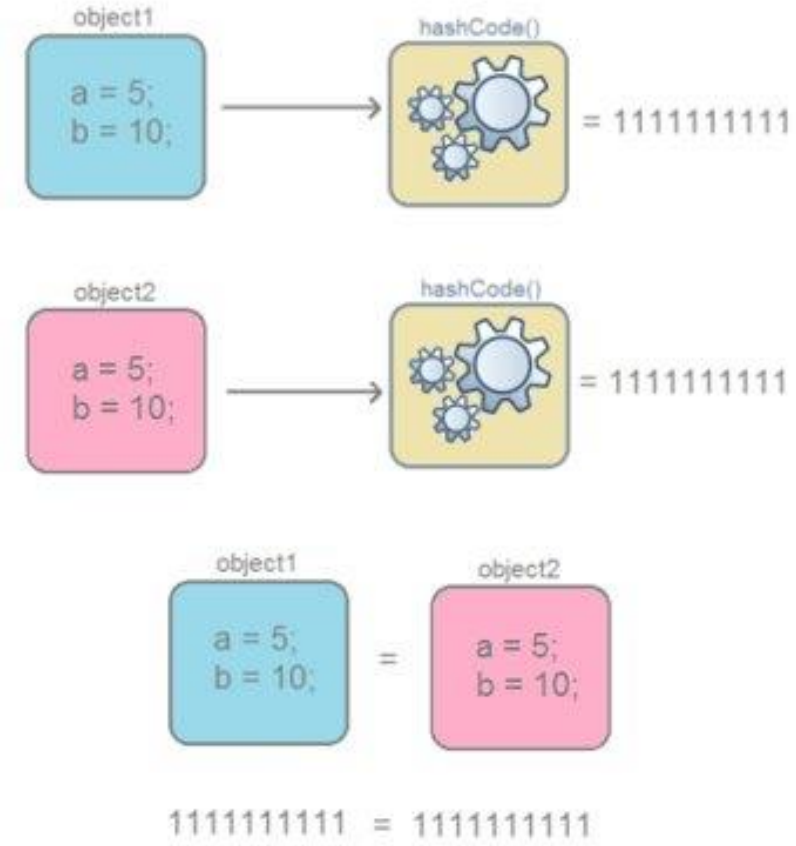
```
@Override
public boolean equals(Object o) {
   if (this == o) {
      return true;
   }
   if (o == null || getClass() != o.getClass()) {
      return false;
   }
   Car car = (Car) o;
   return Double.compare(car.fuel, fuel) == 0 &&
         Double.compare(car.currentSpeed, currentSpeed) == 0;
}

@Override
public int hashCode() {
   return Objects.hash(fuel, currentSpeed);
}
```

Equals Hashcode contract

Same object



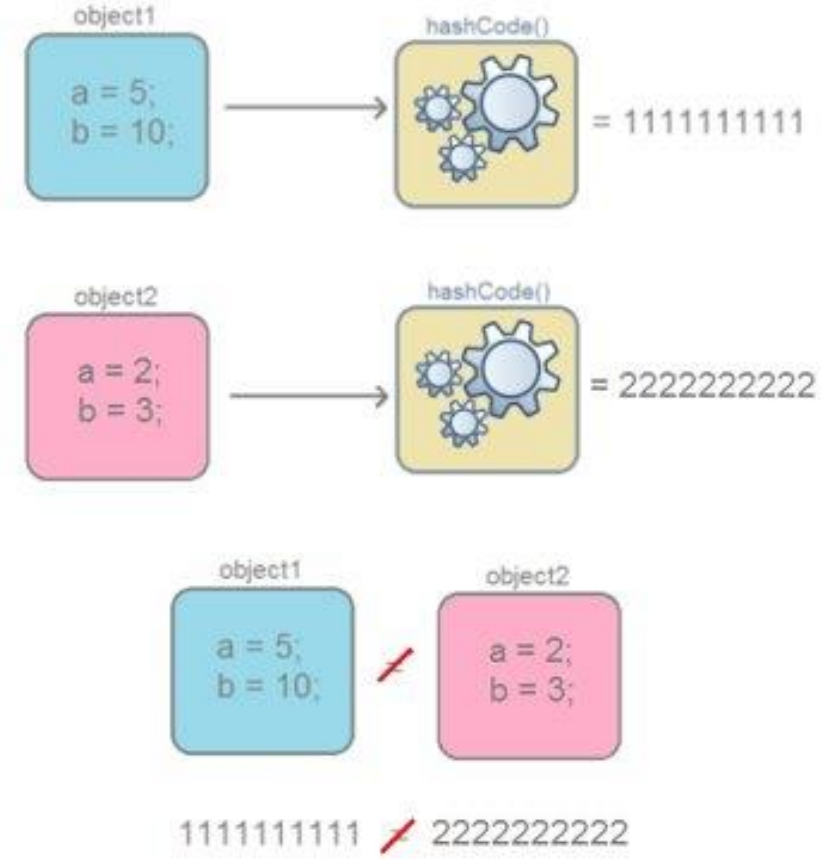
Similar objects



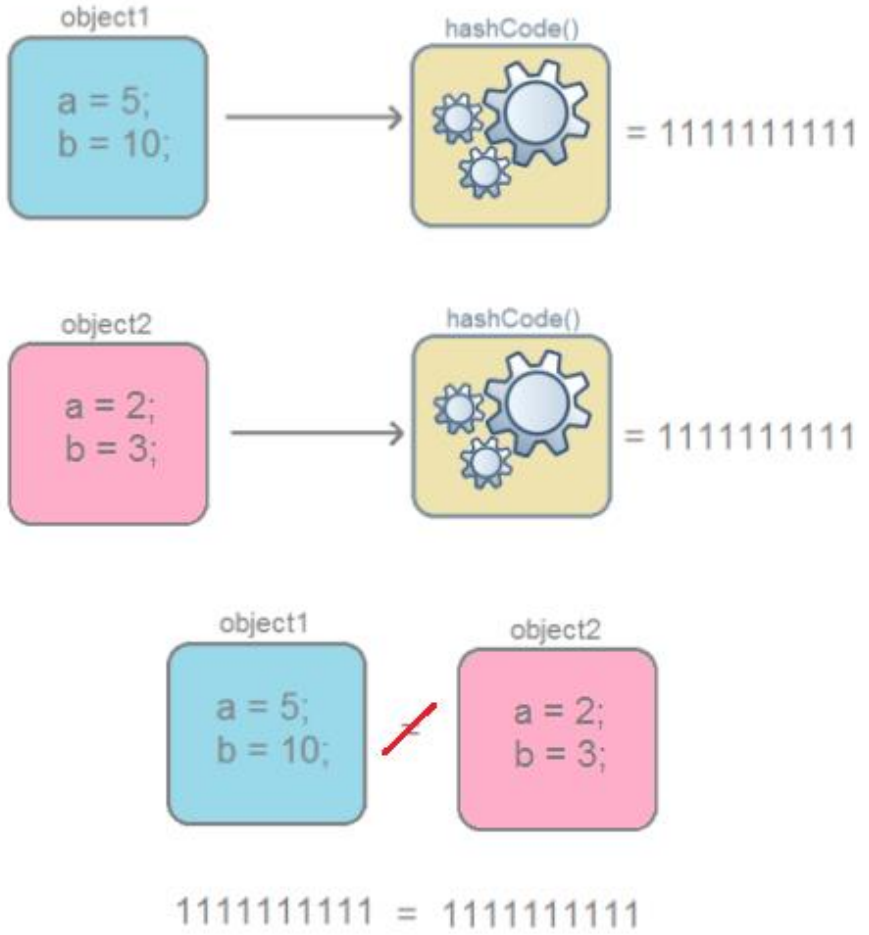
https://habr.com/ru/post/168195/

Equals Hashcode contract

Different objects



Different objects (collision)



https://habr.com/ru/post/168195/

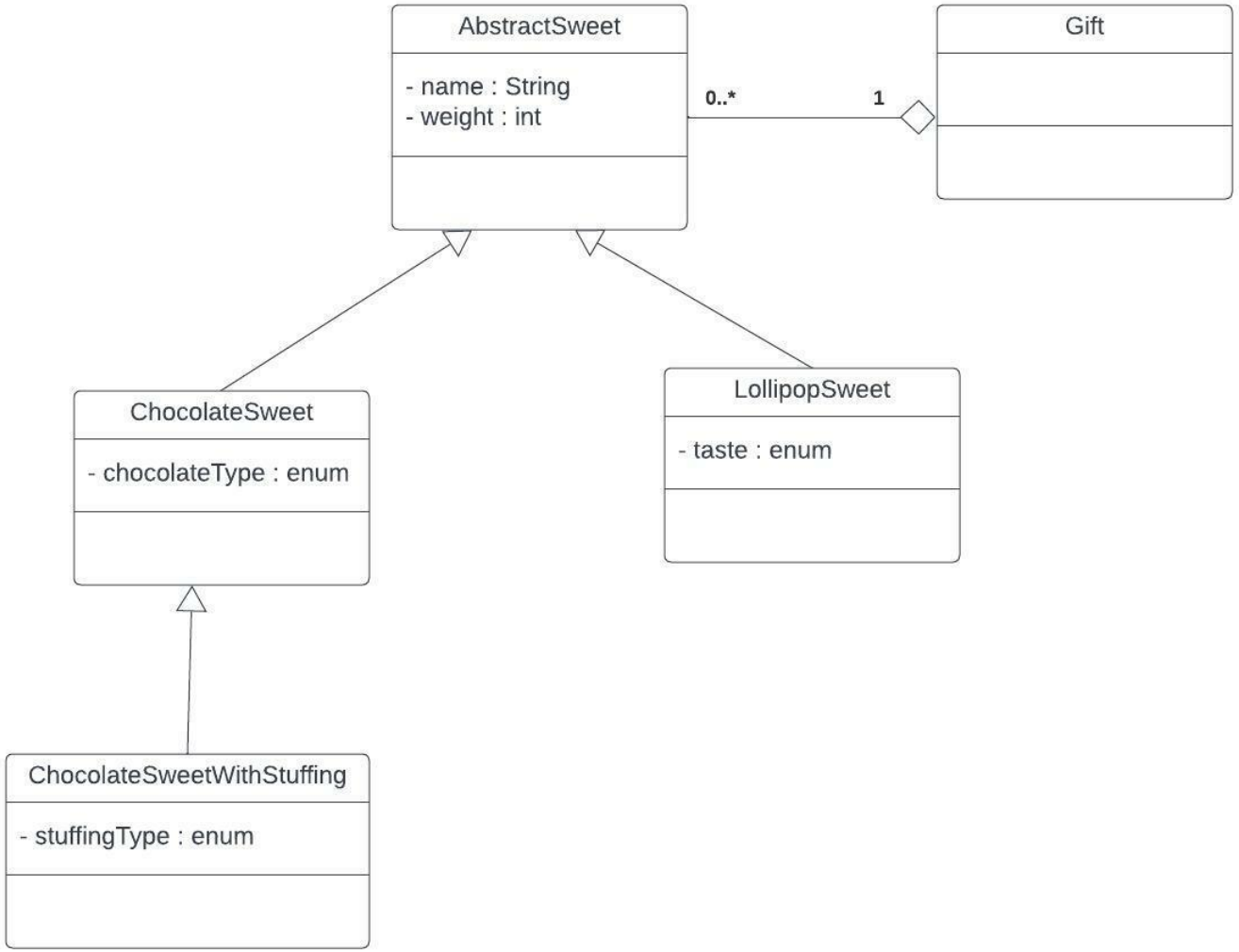
Overriding Equals: Rules

- Reflexive: **x** *equals* **x**, an object must equal to itself.
- Symmetry: if **x** *equals* **y** then **y** equals x == true.
- Transitive: if **x** *equals* **y** and **y** *equals* **z** then **x** *equals* **z**
- Consistent: if **x** *equals* **y** and no value is modified, then it's always true for every call
- For any non-null object **x**, **x** *equals* **null** == false

Homework

- **Christmas gift.** Define the hierarchy of candies and other sweets. Create several candy objects. Collect a child's gift and determine its weight.

Homework


AbstractSweet
- name : String
- weight : int
0..*
1
Gift
ChocolateSweet
- chocolateType : enum
LollipopSweet
- taste : enum
ChocolateSweetWithStuffing
- stuffingType : enum

Books

- Sierra, Kathy. Head First Java
- Eckel, Bruce. Thinking in Java

Links

- https://www.baeldung.com/java-classes-objects
- https://www.baeldung.com/java-constructors
- https://www.baeldung.com/a-guide-to-java-enums
- https://www.w3schools.com/java/java_inheritance.asp
- https://www.baeldung.com/java-method-overload-override
- https://dzone.com/articles/working-with-hashcode-and-equals-in-java
- https://www.w3schools.com/java/java_encapsulation.asp
- https://www.visual-paradigm.com/guide/uml-unified-modeling-language/uml-class-diagram-tutorial/

Thanks