# COMP2511

## WEEK 8

What train line do you take?

What time did you sleep?

# ADMIN STUFF

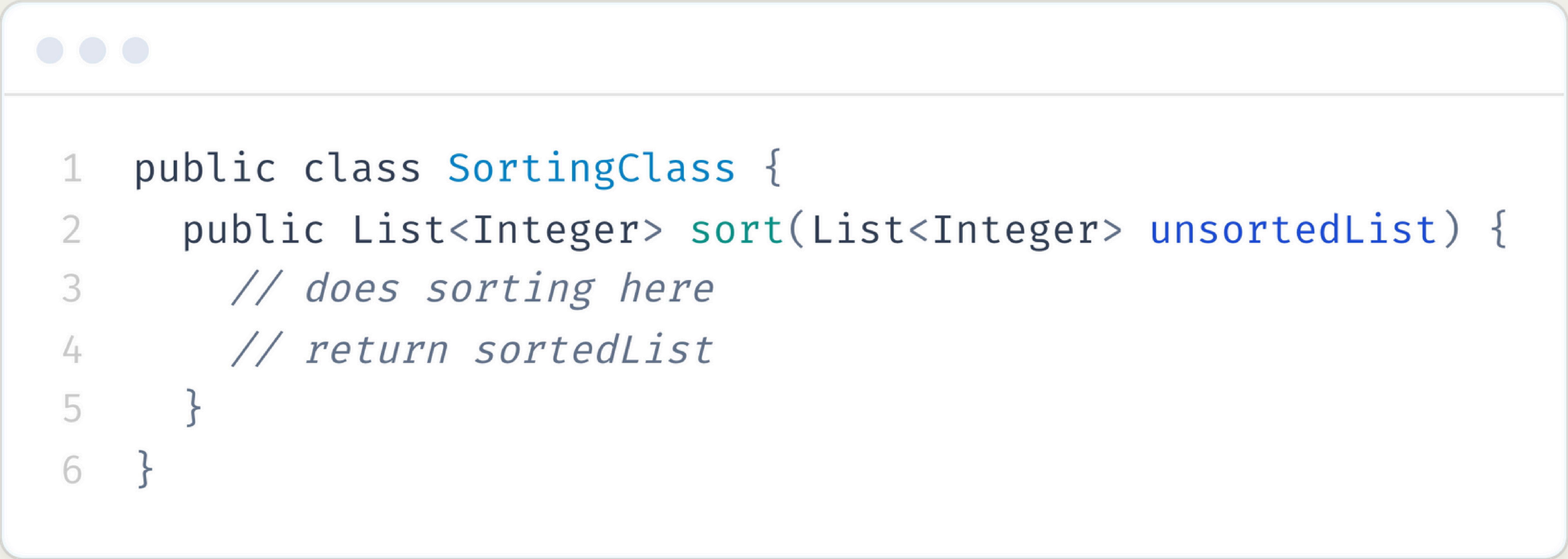
- Assignment-i marks out, can request re-run
- Assignment-ii due Week 9 Friday 5pm
- Let me know if you would like to do assignment-iii in (different) pairs or individually
- Week 10 will provide a sample exam environment
- Check your lab marks

# AGENDA

- Generic Programming
- Singleton Pattern & Synchorisation

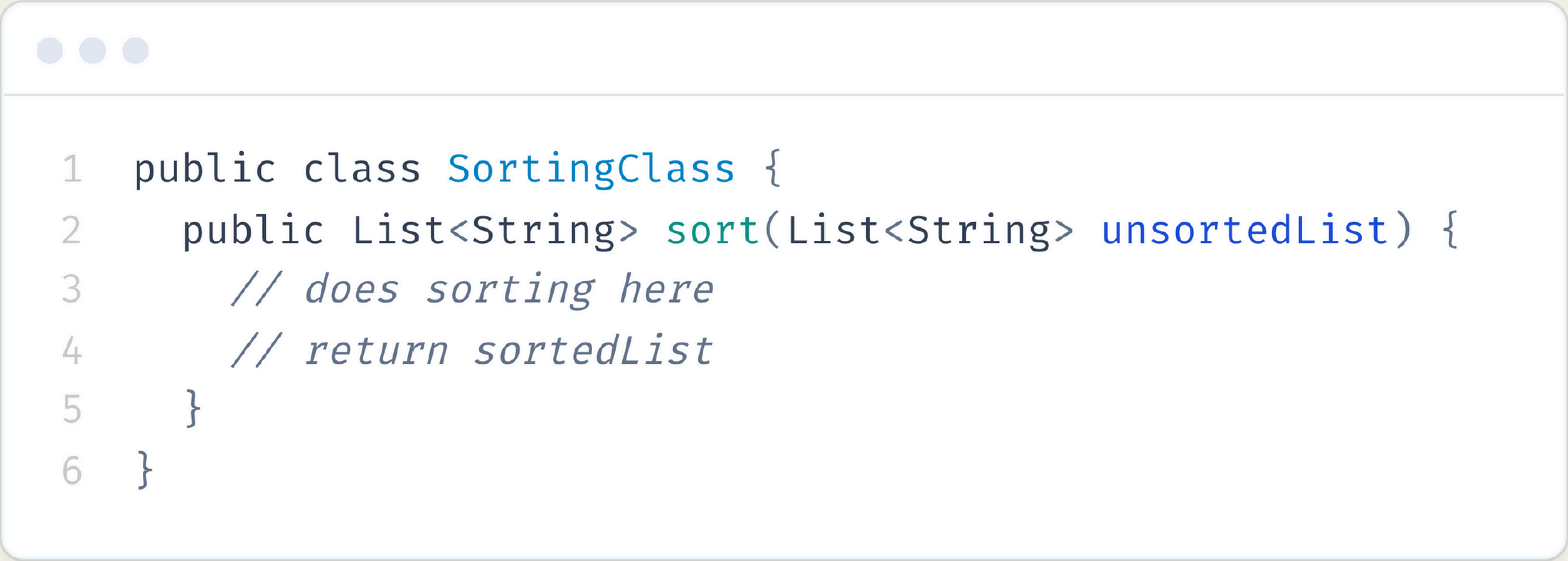
# Generics

# GENERIC PROGRAMMING



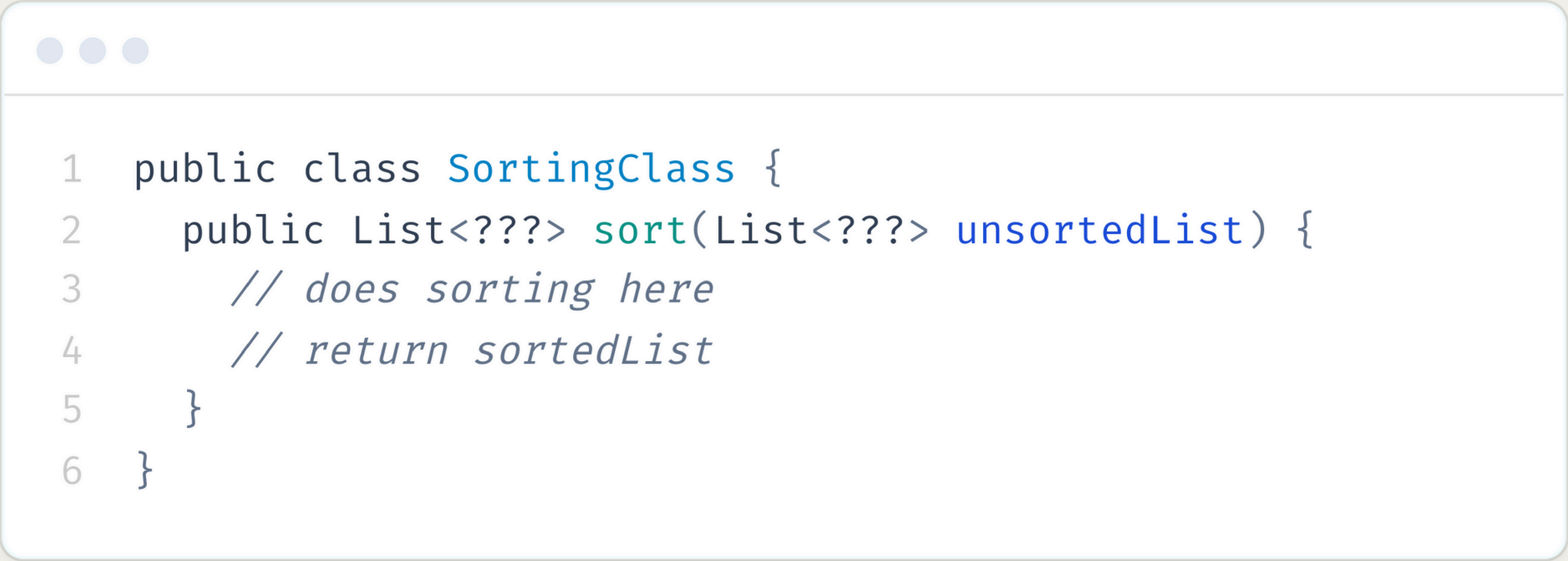
```java
public class SortingClass {
  public List<Integer> sort(List<Integer> unsortedList) {
    // does sorting here
    // return sortedList
  }
}
```

# GENERIC PROGRAMMING



```java
public class SortingClass {
  public List<String> sort(List<String> unsortedList) {
    // does sorting here
    // return sortedList
  }
}
```

# GENERIC PROGRAMMING



```
public class SortingClass {
  public List<???> sort(List<???> unsortedList) {
    // does sorting here
    // return sortedList
  }
}
```

# GENERIC PROGRAMMING

## What are generics?

Generics enable types to be passed when defining classes, interfaces or methods

- Remove casting and offer stronger type checks at compile time
- Allow implementations of generic algorithms, that work on a collection of different types
- Adds stability to code by making more of your bugs detectable at run-time

The *List* class is a perfect example of *Java Generics*.

- *List<Integer>*
- *List<String>*
- *List<List<Double>>*
- *etc...*

# GENERIC PROGRAMMING

Inside **src/stack**, there are a series of stubs for a Stack class which takes in a generic type. There are a series of tests inside **StackTest.java** which currently fail.

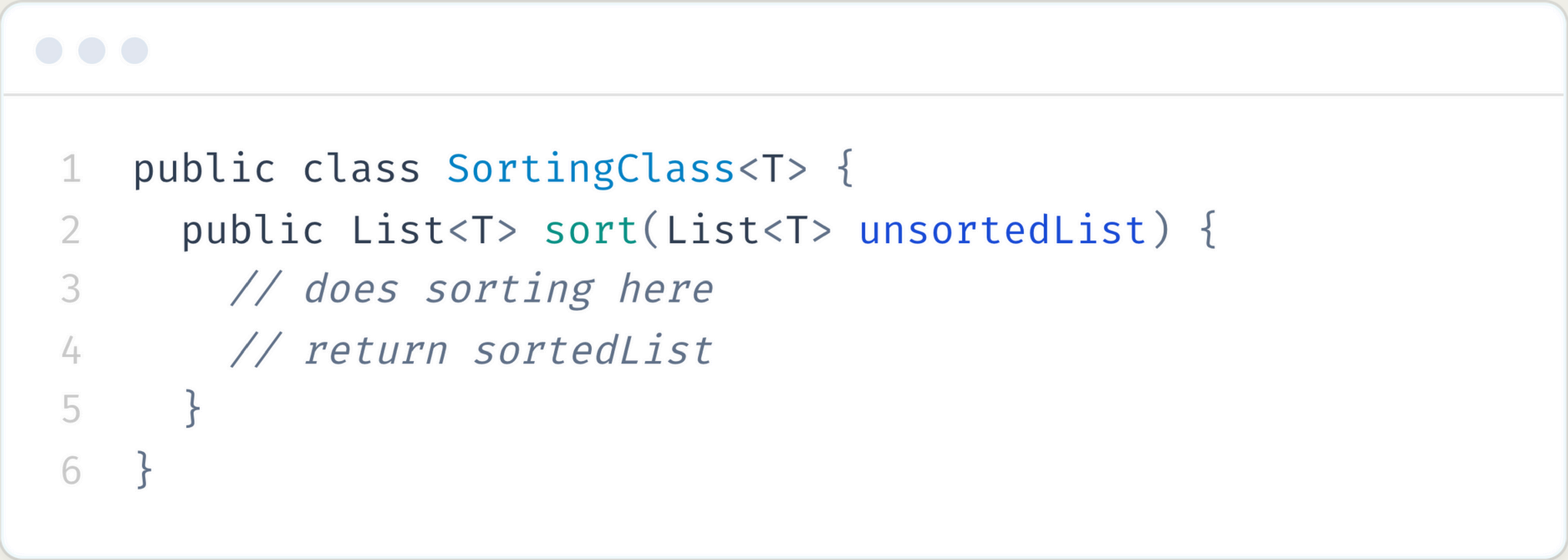
Implement the methods so that the tests pass, using an ArrayList to store the internal data structure. Answer the following questions:

1. What is E?
2. What is the Iterable interface? Why does it have an E as well? What methods does it force us to implement?
3. When completing toArrayList, why do we need to make a copy rather than just returning our internal ArrayList?
4. What does the .iterator() method allow us to do? Discuss the test inside StackTest.java.

# GENERIC PROGRAMMING

- **What is E?**
  - Generic type
- **What is the Iterable interface? Why does it have an E as well? What methods does it force us to implement?**
  - Iterable: Something that can be iterated over
  - Forces us to implement the .iterator() method
- **When completing toArrayList, why do we need to make a copy rather than just returning our internal ArrayList?**
  - Don't want to break encapsulation
- **What does the .iterator() method allow us to do? Discuss the test inside StackTest.java.**
  - .iterator() allows us to loop through it like a normal collection

# GENERIC PROGRAMMING



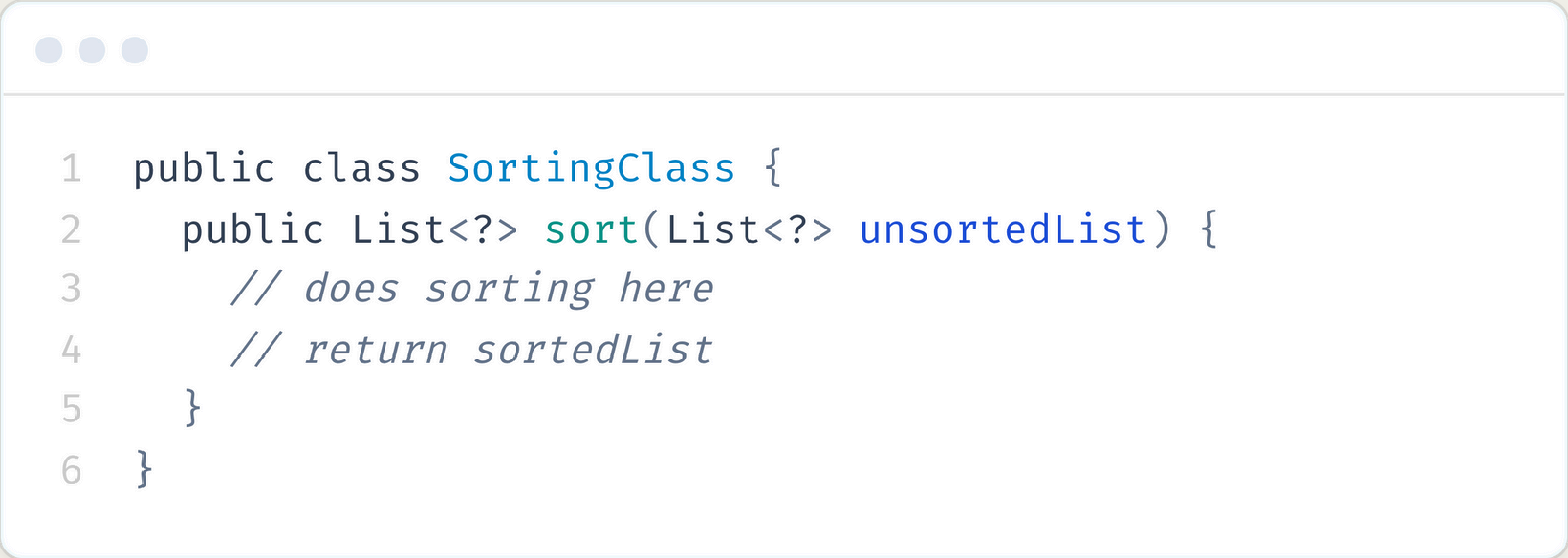
```java
public class SortingClass<T> {
  public List<T> sort(List<T> unsortedList) {
    // does sorting here
    // return sortedList
  }
}
```

T = type     K = key     V = value

# GENERIC PROGRAMMING

**What if I want to modify one method without touching the class?**

Wildcards are your answer (kinda)



```java
public class SortingClass {
  public List<?> sort(List<?> unsortedList) {
    // does sorting here
    // return sortedList
  }
}
```

Note: wildcards can not be used as a type

# GENERIC PROGRAMMING

For the previous snippet of code, all the following are valid parameters with no compilation errors however this will produce a runtime error.

```java
List list = Arrays.asList(3, 2, 5, 1, 4);
```

```java
List list = Arrays.asList("B", "A", "E", "C", "D");
```

```java
List list = Arrays.asList(2, "A", 1, 3.4, "D");
```

Make sure you specify the type of the list instead of using the raw list class.

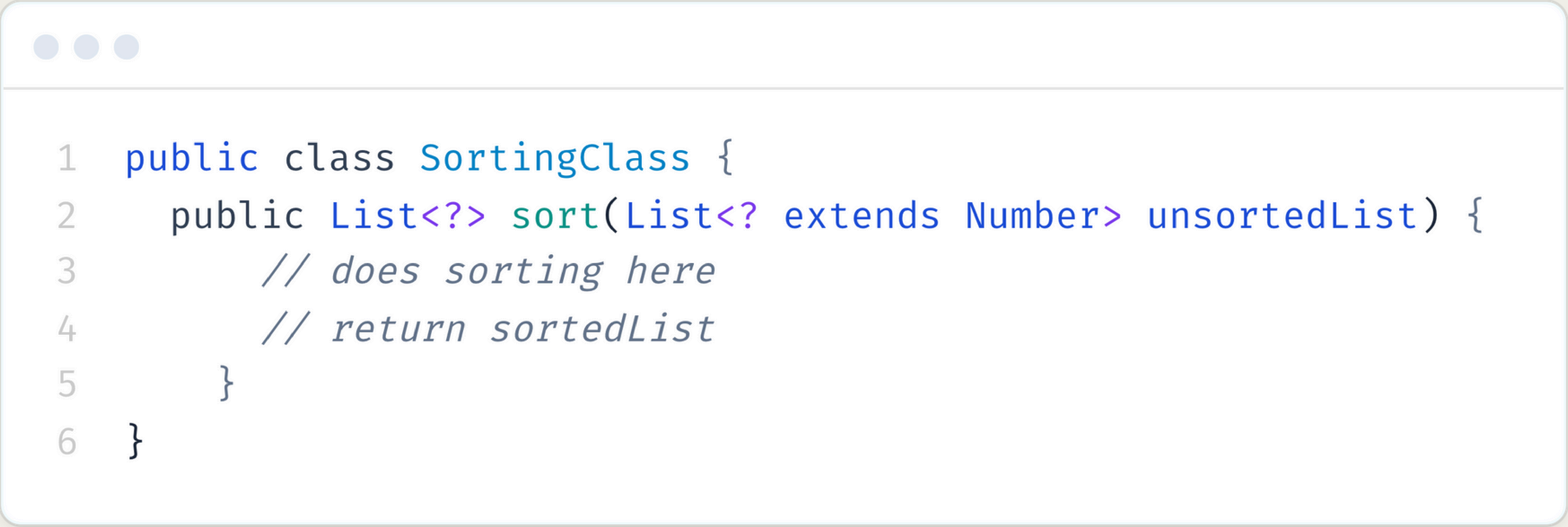
ALWAYS DO THIS

# GENERIC PROGRAMMING

## Bounded wildcards

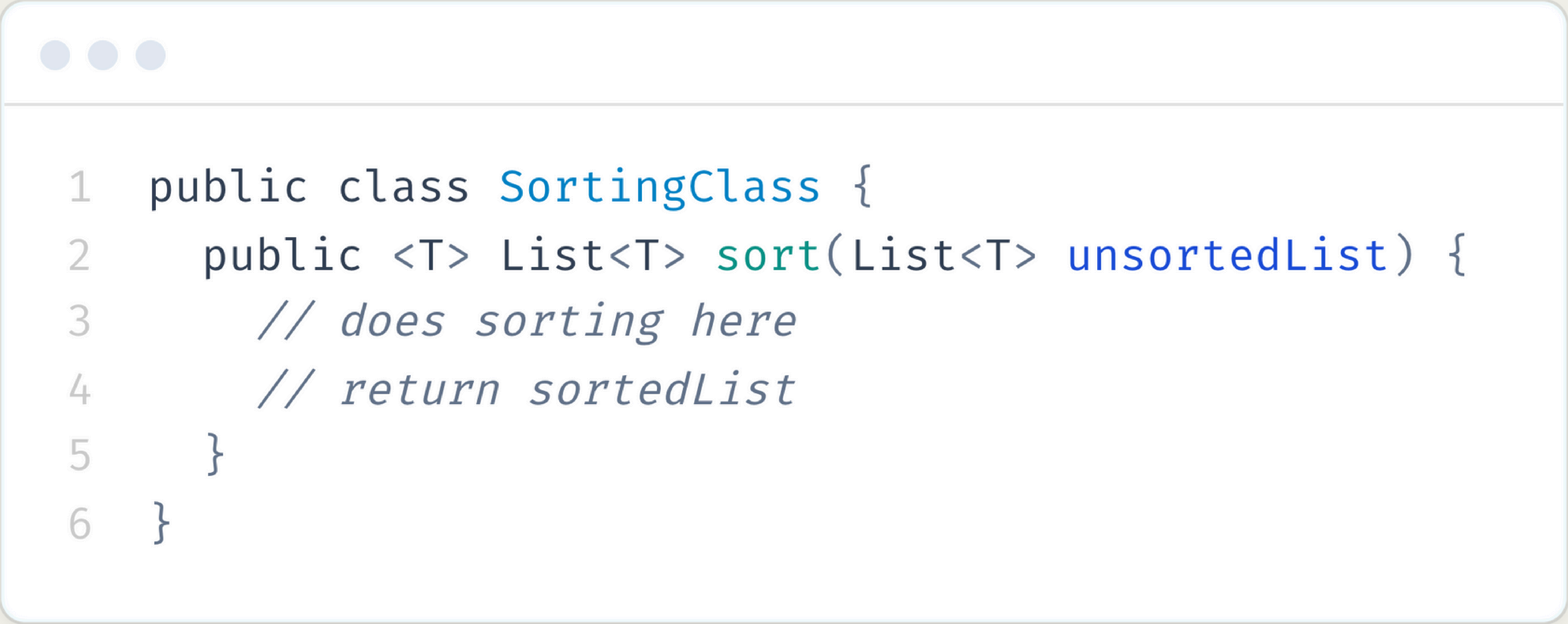
**What does <? extends Type> and <? super Type> mean?**

- extends : the parameterized type must be a class or subclass of the given type
- super : the parameterised type must be a class or super class of the given type



```java
public class SortingClass {
  public List<?> sort(List<? extends Number> unsortedList) {
      // does sorting here
      // return sortedList
    }
}
```

# GENERIC PROGRAMMING



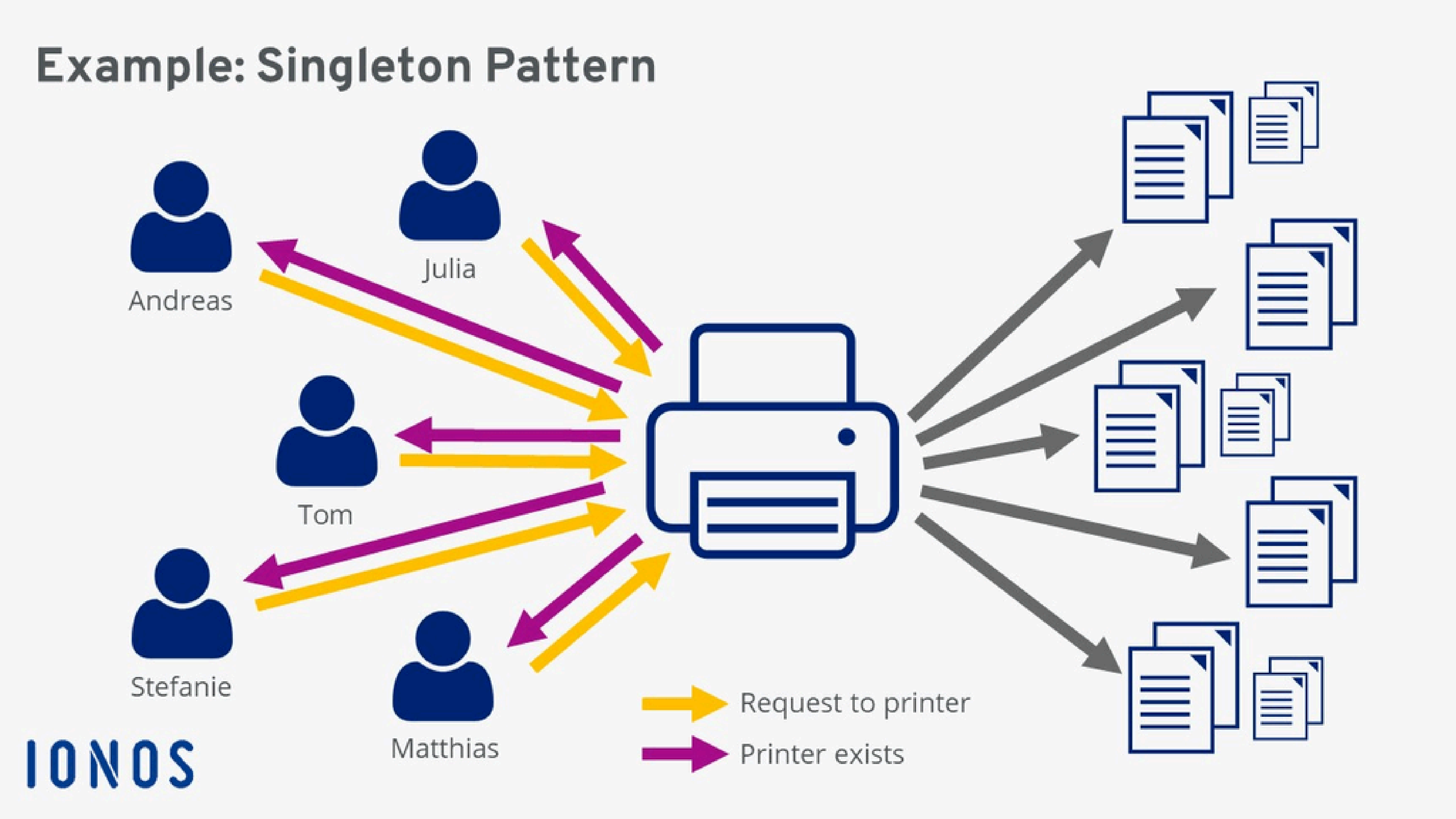
```java
public class SortingClass {
  public <T> List<T> sort(List<T> unsortedList) {
    // does sorting here
    // return sortedList
  }
}
```

# Singleton Pattern

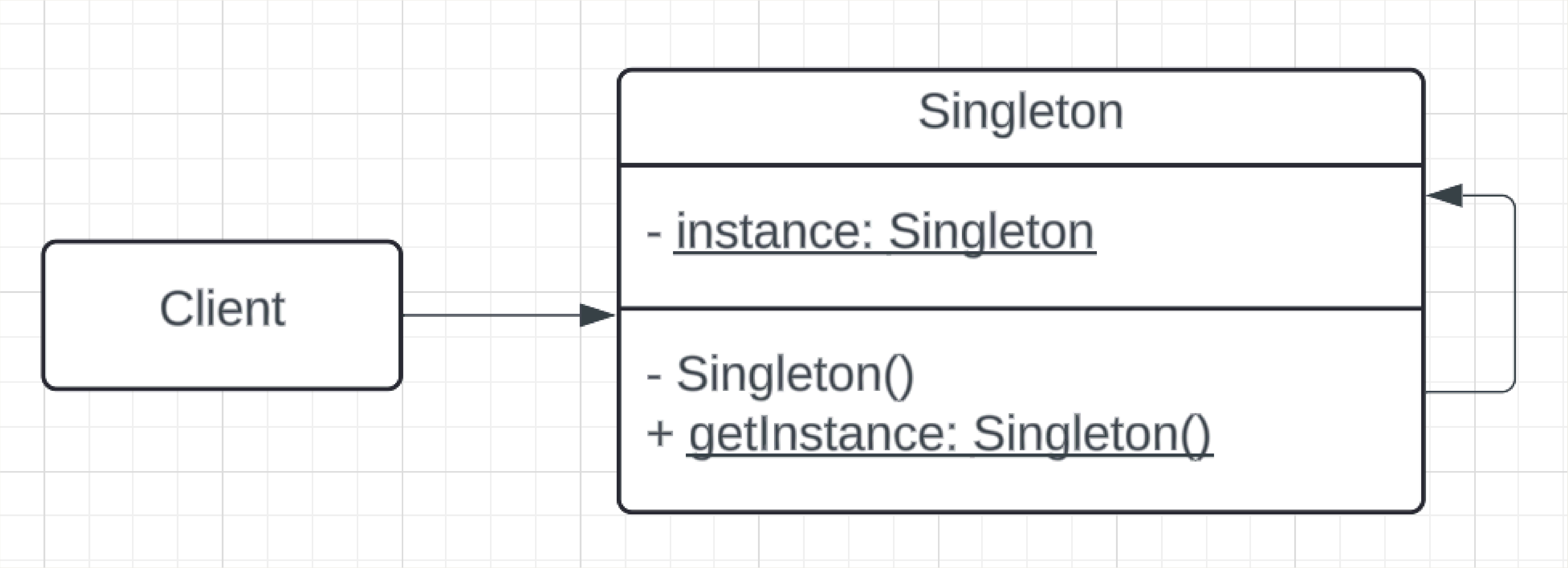
# SINGLETON PATTERN

Singleton is a creational design pattern that lets you ensure that a class has only one instance, while providing a global access point to this instance.

It helps avoid initialisation overhead when only 1 copy of an instance is needed.



# SINGLETON PATTERN



Client

Singleton

- instance: Singleton

- Singleton()
+ getInstance: Singleton()

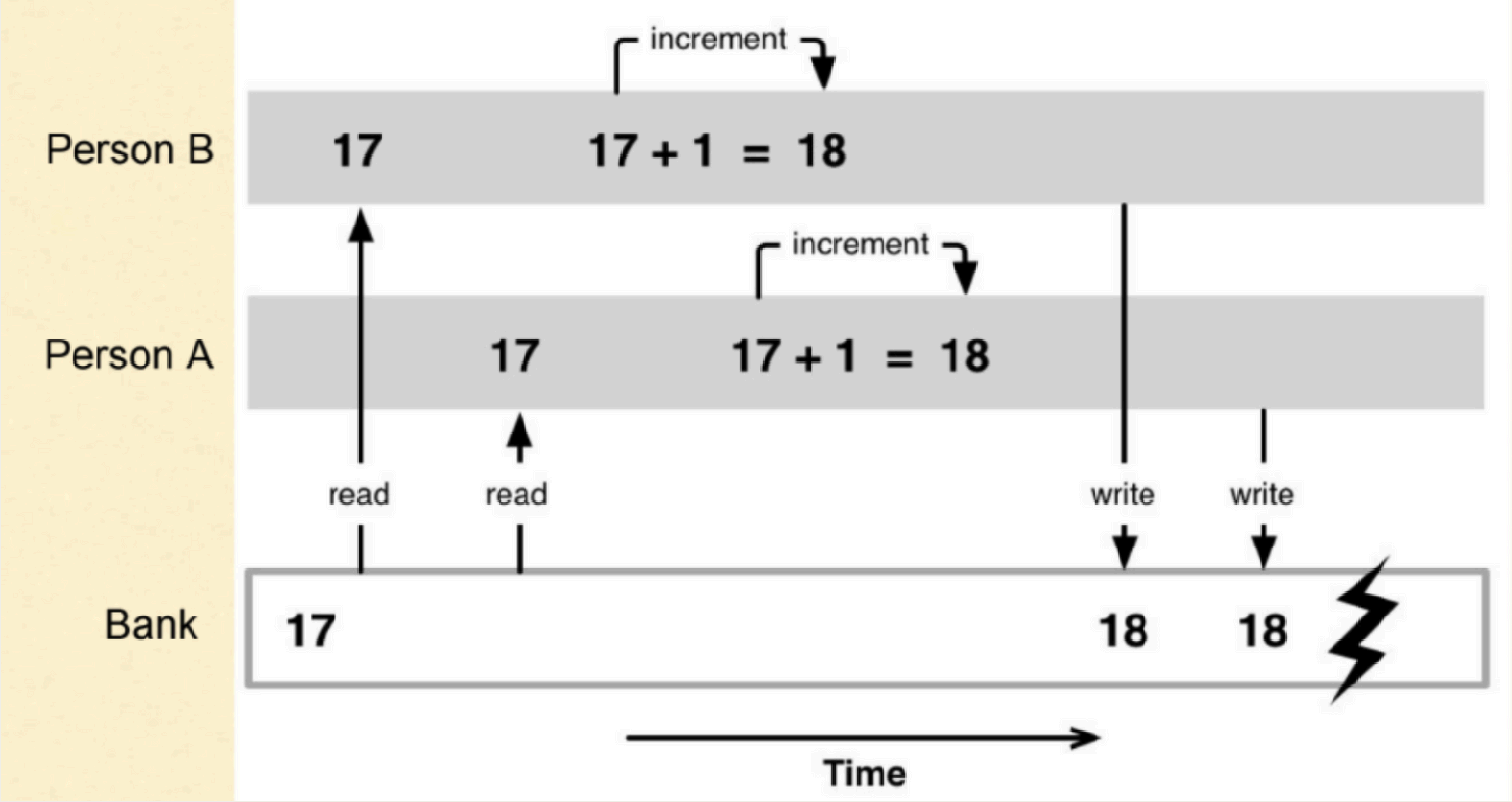
# SINGLETON PATTERN

Consider the Bank Account class from Lab 04.

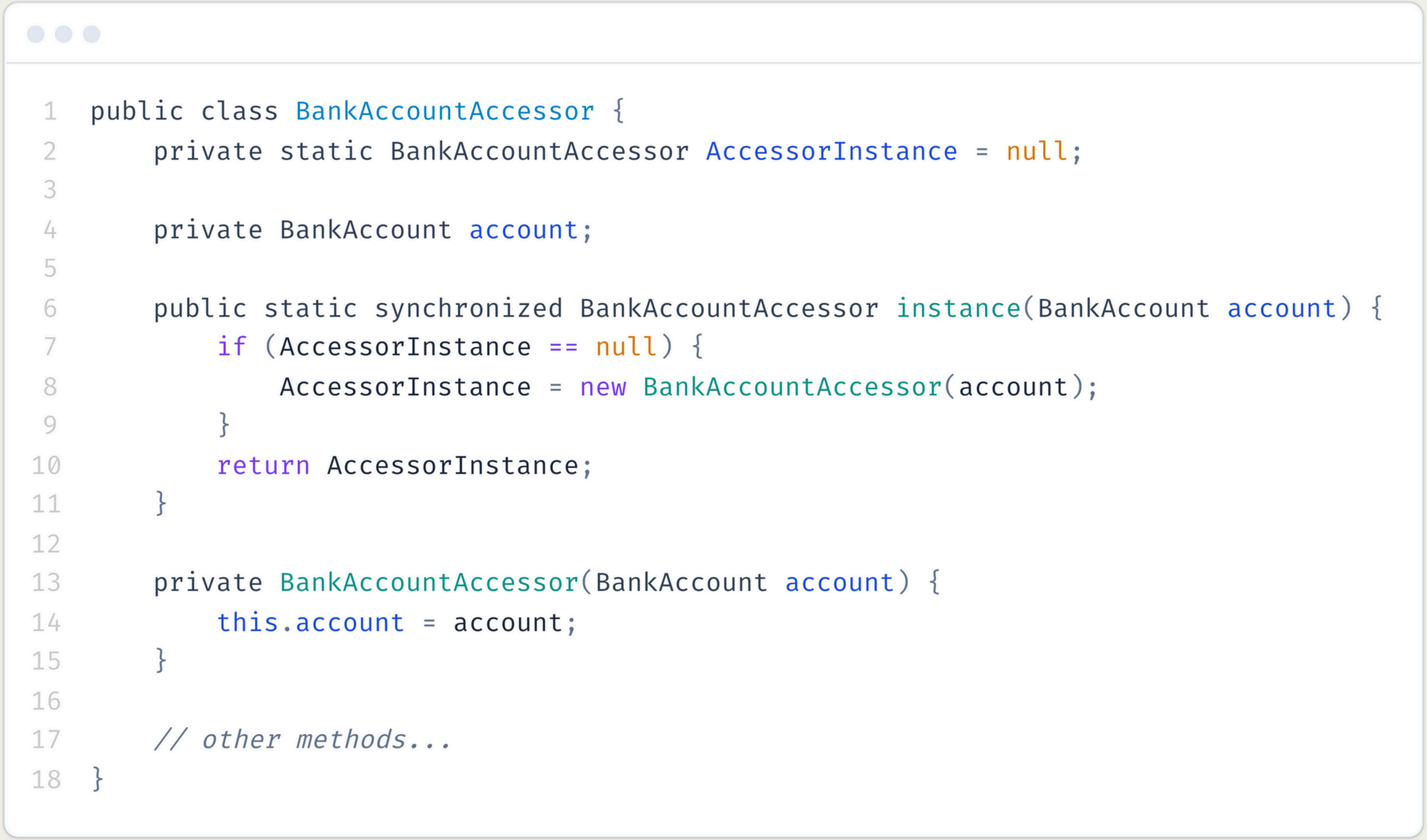
What if multiple people try to access the bank account at the same time? Inside **src/unsw/heist** are three classes:

- BankAccount, from Lab 04.
- BankAccountAccessor. Objects of this type are an instance of an access to a bank account to withdraw money a given number of times by given amounts.
- BankAccountThreadedAccessor, which extends Thread, and overrides the method run to create a new instance of BankAccountAccessor and access the bank.

# SINGLETON PATTERN



# SINGLETON PATTERN



```java
public class BankAccountAccessor {
    private static BankAccountAccessor AccessorInstance = null;

    private BankAccount account;

    public static synchronized BankAccountAccessor instance(BankAccount account) {
        if (AccessorInstance == null) {
            AccessorInstance = new BankAccountAccessor(account);
        }
        return AccessorInstance;
    }

    private BankAccountAccessor(BankAccount account) {
        this.account = account;
    }

    // other methods...
}
```

# LABBY YOO

WOOO