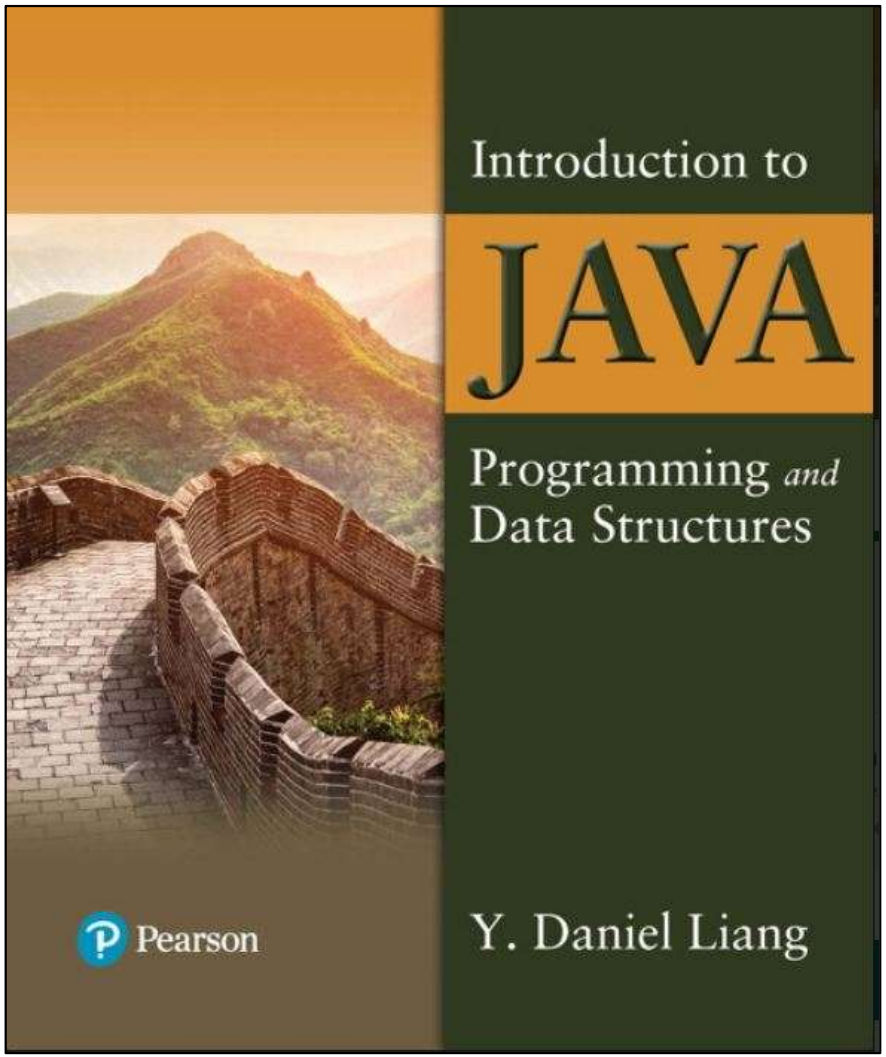
Introduction to Java Programming and Data Structures

Twelfth Edition



Chapter 13

Abstract Classes and Interfaces

Review Last Chapter

- Exception Handling

```
try {
  statements;
}
catch (TheException ex) {
  handling ex;
}
finally {
  finalStatements;
}
```

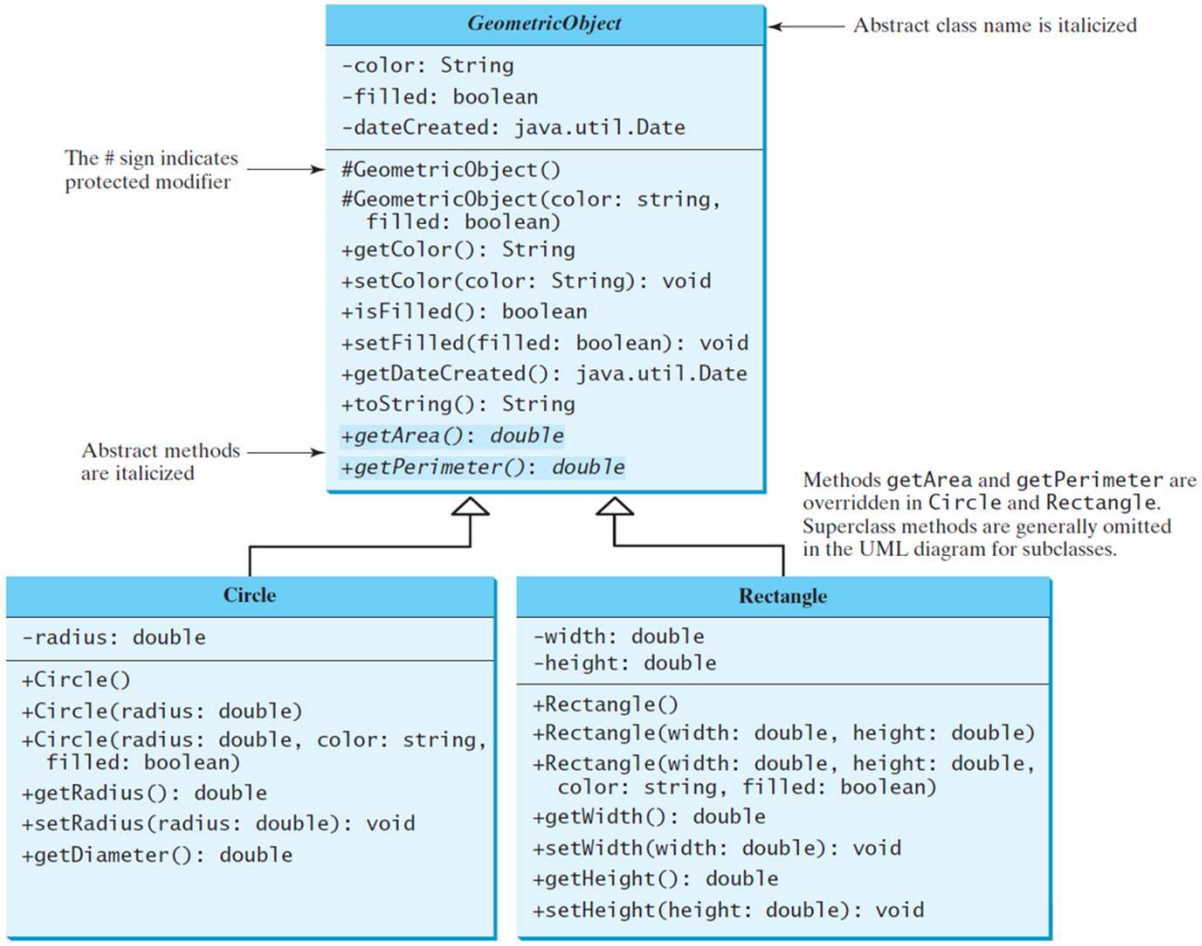
- Text I/O
  “File”
  “PrintWriter”
  “Scanner”

Review Inheritance

- For “person” in a University System, there are THREE kinds: student, faculty, staff.
  Is there any one Not student, Not faculty, Not staff?

- Furniture, sofa, bed, sofabed
  What is the inheritance hierarchy?

Abstract Classes and Abstract Methods



GeometricObject

Circle

Rectangle

TestGeometricObject

Abstract Method in Abstract Class

An abstract method cannot be contained in a nonabstract class. If a subclass of an abstract superclass does not implement all the abstract methods, the subclass must be defined abstract. In other words, in a nonabstract subclass extended from an abstract class, all the abstract methods must be implemented, even if they are not used in the subclass.

Object Cannot be Created From Abstract Class

An abstract class cannot be instantiated using the new operator, but you can still define its constructors, which are invoked in the constructors of its subclasses. For instance, the constructors of GeometricObject are invoked in the Circle class and the Rectangle class.

Abstract Class Without Abstract Method

A class that contains abstract methods must be abstract. However, it is possible to define an abstract class that contains no abstract methods. In this case, you cannot create instances of the class using the new operator. This class is used as a base class for defining a new subclass.

Superclass of Abstract Class May Be Concrete

A subclass can be abstract even if its superclass is concrete. For example, the Object class is concrete, but its subclasses, such as GeometricObject, may be abstract.

Concrete Method Overridden to Be Abstract

A subclass can override a method from its superclass to define it abstract. This is rare, but useful when the implementation of the method in the superclass becomes invalid in the subclass. In this case, the subclass must be defined abstract.

Abstract Class as Type

You cannot create an instance from an abstract class using the new operator, but an abstract class can be used as a data type. Therefore, the following statement, which creates an array whose elements are of GeometricObject type, is correct.

```
GeometricObject[] geo = new GeometricObject[10];
```

Practice

- Use the online compiler today. Google “programiz java”

- Online Java Compiler – Programiz

Abstract Class “Person”

```
class Main {
    public static void main(String[] args) {
        System.out.println("Hello world");
    }
}
abstract class Person{
    String name;
    public abstract void methodExample();
}
class Student extends Person{
    int studentID;
    public void methodExample(){
        System.out.println("must implement abstract method");
    }
}
```

Object Cannot be Created From Abstract Class

```
class Main {
    public static void main(String[] args) {
        System.out.println("Hello world");
        Person p = new Person();
    }
}
abstract class Person{
    String name;
    public abstract void methodExample();
}
class Student extends Person{
    int studentID;
    public void methodExample(){
        System.out.println("must implement abstract method");
    }
}
```

Abstract method in Concrete Class?

- Remove “abstract” from “class Person”

Abstract class as a type

- Person p = new Student()

- Please define an abstract class “Animal” with one or two abstract method

- Please define a subclass “Pet”

- Instantiate one Pet object.
- Instantiate one Animal that refers to Pet object.