Advanced Object Orientation - Part II

CSC02A2

Outline

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Abstract Classes and Interfaces

Concept of an Abstract class

Inheritance specialises classes further down the class hierarchy. Abstraction is the converse: the higher up the class hierarchy the more generalised classes become.

Once a superclass becomes generalised to a point where creating instances of the class is not meaningful such classes can be marked as abstract classes.

In the same line once a specific behaviours in an abstract class cannot be provided a meaningful definition and can also be marked as abstract methods.

Abstract Classes in Java

- Abstract methods cannot be static.
- Abstract methods cannot be contained in concrete classes.
- A class can be declared abstract without having any abstract methods.
- Abstract classes can have constructors but cannot be instantiated.
- A subclass may be abstract even if the parent class is concrete.
- References to abstract classes can be created.

Interface

Interfaces are a class-like construct that contains abstract methods. Implementation is not allowed[1].

Interfaces are used to define a set of shared behaviours which a group of otherwise unrelated class will share.

Unlike inheritance, a class can realise many interfaces in Java.

The `instanceOf` keyword can be used to test if an instance of an object realises a specific interface.

Note

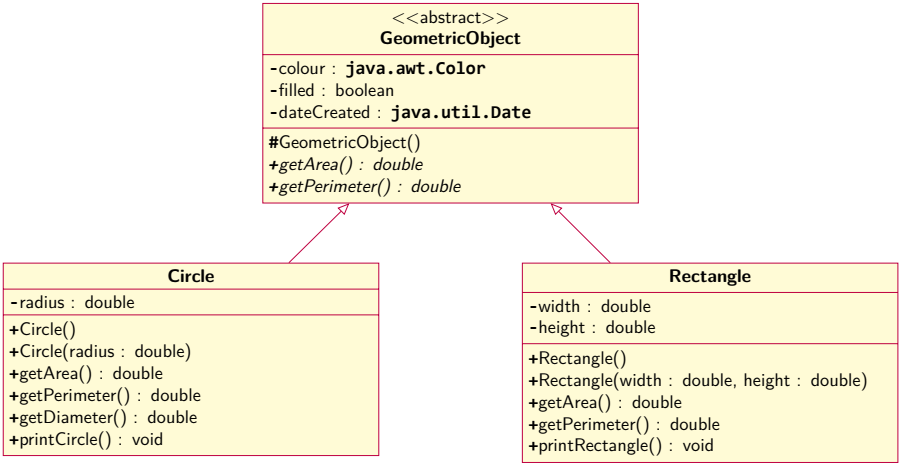
Since `Java SE 1.8` `interfaces` have received a few changes

[1] `default` methods are available but we will not be considering them.

Abstract classes vs Interfaces

Criteria	**Abstract class**	**Interface**
Instance methods	Allowed	Only `abstract` methods
Instance variables	Allowed	Not allowed
Usage	Extend from one class	Realise multiple interfaces
Relationship	***is-a***	***is-kind-of***

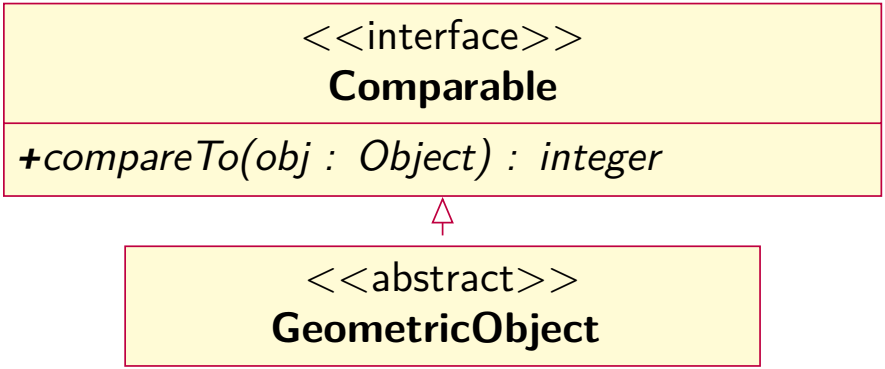
Abstract classes and Interfaces Example I



Abstract classes and Interfaces Example II

```java
import java.awt.Color;
import java.util.Date;
public abstract class GeometricObject
{
    private Color colour = Color.WHITE;
    private boolean filled = false;
    private Date dateCreated = new Date();
    // Accessor methods omitted for brevity
    // Mutator methods omitted for brevity
    public String toString()
    {
        return "Created on " + dateCreated +
               "\nColour " + colour +
               "\nFilled: " + filled;
    }
    public abstract double getArea();
    public abstract double getPerimeter();
}
```


Abstract classes and Interfaces Example III



Abstract classes and Interfaces Example IV

```java
public class GeometricObject implements Comparable
{
    // Old code omitted
    public int compareTo(Object other)
    {
      if(!(o instanceof GeometricObject))
      {
        return 1;
      }
      GeometricObject otherGO = ((GeometricObject)other);
      if(getArea() > otherGO.getArea())
      {
        return 1;
      }
        else if (getArea() < otherGO.getArea())
        {
          return -1;
        }
        return 0;
    }
}
```